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THE RELATIONSHIP OF CREATIVE THINKING TO COLLEGE SUCCESS.

BY- DOWD, ROBERT J.

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DIVERGENT THINKING TESTS, WHICH MEASURE THE ABILITY TO PRODUCE DIVERSE RESPONSES TO PROBLEMS THAT HAVE NO SINGLE ANSWER, AND CONVENTIONAL TESTS OF CONVERGENT THINKING WERE COMPARED TO DETERMINE IF THE TWO TYPES OF TESTS REPRESENTED MORE THAN ONE DOMAIN OF PSYCHOLOGICAL APTITUDE. ALL STUDENTS IN A GENERAL PSYCHOLOGY COURSE WERE TESTED, AND COMPLETE RECORDS WERE OBTAINED FOR 300 FEMALES AND 117 MALES. TWO FORMS OF THE SCHOLASTIC APTITUDE TEST (SAT) WERE THE CONVERGENT THINKING MEASURES. TWO IMAGINATIVE ESSAYS AND ACADEMIC GRADES WERE THE CRITERIA OF CREATIVITY AND ACHIEVEMENT, RESPECTIVELY. THE DIVERGENT THINKING MEASURES, ALL SEMANTIC IN NATURE, WERE "WORD MEANINGS," "ANAGRAM" (SCORED FOR FLUENCY AND UNCOMMONNESS OF RESPONSES), "PLOT TITLES" (SCORED FOR QUALITY AND FLUENCY), "USES" (SCORED FOR FLUENCY AND FLEXIBILITY), AND "CONSEQUENCES" (SCORED THE SAMES AS "USES"). AFTER TESTING, THE FIRST THREE OF THESE MEASURES WERE DISCARDED. RESULTS OF THE INVESTIGATION INDICATED THAT DIVERGENT THINKING TESTS, COMBINED AS MULTIPLE PREDICTORS, (1) ARE BETTER THAN CONVERGENT THINKING TESTS (SAT) AS MEASURES OF CREATIVE PERFORMANCE, AND (2) ARE NOT BETTER THAN CONVERGENT THINKING TESTS AS PREDICTORS OF ACADEMIC ACHIEVEMENT. (AL)

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THE RELATIONSHIP OF CREATIVE THINKING TO COLLEGE SUCCESS

Robert J. Dowd

Final report of Small Contract Project No. 5-8202-
granted by the U. S. Office of Education of the
Department of Health, Education, and Welfare

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Robert J. Dowd

Summary of the final report of Small Contract Project
No. 5-8202 granted by the U. S. Office of Education of
the Department of Health, Education, and Welfare

Divergent thinking tests, which measure the ability to produce diverse responses to problems that have no single answer, and conventional tests of convergent thinking were compared to determine whether the two types of tests represented more than one domain of aptitude.

Five semantic-content tasks yielded nine divergent thinking scores under test conditions. Subjects were 417 college sophomores. SAT-V and SAT-M were the convergent thinking measures. Two imaginative essays and academic grades were the criteria of creativity and achievement, respectively. Statistical procedures included factor analysis and multiple regression analysis.

No consistent sex differences were found for the divergent thinking scores. Six divergent thinking variables formed a cluster distinct from the SATs. Fluency (quantity) scores were more consistently intercorrelated than were scores for flexibility, cleverness, and uncommonness of responses. In combination, but not when taken individually, the divergent thinking measures excelled the SATs as predictors of essay writing performance. The SATs were superior to the combined divergent thinking variables as predictors of academic achievement. Adding SATs to divergent thinking variables improved prediction of essay scores and of one achievement criterion, Social Science grades.

It was concluded that there are semantic divergent thinking and convergent thinking tests that measure different aspects of intellectual aptitude. The former are more closely related to judged creative verbal performance, the latter to success in conventional academic programs.

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CHAPTER I

STATEMENT AND DEFINITION OF THE PROBLEM

Statement of the problem

Everyone agrees that "creativity" is important, but there is little agreement about what it is, how it is distributed, or how it should be studied. Yamamoto (1965) used the metaphor of the blind men and the elephant to describe the current state of creativity research. McNemar (1964, p.876) also found this field to be chaotic, and commented, "The definition of creativity is confounded by the diversity of subareas within the field, the criterion problems are far from licked, and so little is known about the creative process that measuring instruments are, seemingly, chosen on a trial-and-error basis."

No doubt, these observations are valid, but the problems are not impossible to resolve. Creativity research that has the purpose of clarifying basic concepts and relationships should help to reduce the confusion and controversy. The present study aims to contribute to better understanding by dealing with some of the most basic, yet persistent, questions in creativity research: What is the nature of relationships of "creativity tests" to each other, to judged creative performance, and to conventional measures of aptitude? How useful are "creativity tests" for predicting academic achievement? Are there any important sex differences in performance on these tests?

Definition of terms

This study aims to provide evidence that is pertinent to the questions raised in the preceding paragraph. In reporting this study the following definitions will prevail:

Creativity: The definition given by Drevdahl (1956, p. 22) conveys the essential meaning of the concept as it was used in the present study. Described by its author as "a distillation of the various definitions that have been proposed in the literature", it reads as follows:

> Creativity is the capacity of persons to produce compositions, products, or ideas of any sort which are essentially new or novel, and previously unknown to the producer. It can be imaginative activity, or thought synthesis, where the product is not a mere summation. It may involve the forming of new patterns and combinations of information derived from past experience, and the transplanting of old relationships to new situations and may involve the generation of new correlates. It must be purposeful or goal directed, not mere idle fantasy--although, it need not have immediate practical application or be a perfect and complete product. It may take the form of an artistic, literary, or scientific production or may be of a procedural or methodological nature.

Divergent Thinking: Introduced into the literature by Guilford (1959, p. 381) and described as one of the basic types of intellectual operations in his system of factors that comprise the "structure of intellect", divergent thinking is defined as "the kind that goes off in different directions. It makes possible changes of direction in problem solving and also leads to a diversity of answers, where more than one answer may be acceptable."

Convergent Thinking: Also named by Guilford (1959, p. 376) and included as a basic type of intellectual operation in the "structure of intellect", convergent thinking consists of the abilities involved in arriving at the one correct answer or solution to a problem. Conventional tests of aptitude and achievement consist almost exclusively of this kind of item.

Previous related work

In their survey of tests of creativity, Taylor and Holland (1962) opened the report with the comment, "Research knowledge about creativity is scanty." They referred to the recency of intensive research in the field, for it is only in the last dozen years that any but sporadic efforts have been made in the application of psychometrics to the problem of identifying, understanding, and predicting creativity. The usual approach had been to study single variables, often measures of intelligence, as they relate to creative productivity. The work of Guilford, made feasible by the availability of high-speed computers, culminated in his multi-factorial conception of the "Structure of Intellect", perhaps a milestone in the history of this topic (Guilford, 1959). An immediate consequence of the new view of intellect was a renewal of interest in studying various manifestations of intellectual processes, aided now by the wide availability of computers that handle multivariate data economically. The group of factors that Guilford identified as the "divergent thinking" type of intellectual operation was seen as providing a worthwhile approach to the study of the "creative" person, process, and product.

Contrasting with conventional tests of ability or achievement that require one correct answer (and measure Guilford's "convergent thinking" type of intellectual operation), the divergent thinking type of test assesses the ability of the subject to produce multiple, diverse, uncommon, or original responses to problems that have no single, correct answer.

For some users, the divergent responses were seen as correlates of the fluent and flexible functioning assumed to characterize creative performance in "real life". Others took divergence on the tests to be a direct measure of creativity. The divergent thinking tests are often called "creativity tests", but it is not always clear which of the two meanings is implied. Getzels and Jackson (1962), Torrance (1962), and Wallach and Kogan (1965) have used summed "creativity test" scores to identify "creative" subjects, and then proceeded to seek correlates in other dimensions of individual differences. This approach seems to some observers to short-cut the criterion problem (Thorndike, 1963; McNemar, 1964).

Another criticism of the practice of combining creativity tests to form a single composite score has been made on the grounds that creativity measures lack sufficient equivalence to be used in this manner (Thorndike, 1963).

Getzels and Jackson (1962) reported that "high-creative" students achieved as well in school as did "high-intelligences" students, despite lower intelligence scores. For the entire sample, they found low correlations between creativity tests and intelligence scores, and higher correlations between creativity tests and verbal-content school achievement than between the latter and IQ. This study generated considerable research into the relationships between creativity, intelligence, and achievement (Torrance, 1962: Yamamoto, 1964;

Cline, Richards, and Needham, 1963; Flescher, 1963). Several reviews of the Getzels and Jackson publication have been critical of the research design and the tendency to generalize findings from a highly selected sample (DeMille & Merrifield, 1962; Coffman, 1963). It has also been observed that, had regression effects been taken into account, the results would have been less "unexpected" (McNemar, 1964).

Wallach and Kogan (1965) reviewed the literature and found no basis for any claim that "creativity" and "intelligence" are terms that refer to different unitary psychological dimensions. They pointed out that the creativity indices were no more related to each other than to intelligence measures. From their own investigation, however, they reported positive results. Their creativity measures were relatively homogeneous, and essentially uncorrelated with intelligence. It is their contention that the method of measuring creativity has been incorrect in previous studies. Arguing that creative behavior is more likely to occur in a leisurely, playful, unstressful atmosphere, they proceeded to eliminate all "test-like" features from the data-gathering situation. Two assistants made behavioral observations and secured responses to the creativity measures in a relaxed, friendly, game-like setting. There were, of course, no time-limits to any of the procedures. The principal investigators were critical of previous studies for failing to take into account the "social setting" of the data-gathering process, but seem less concerned with the role of the observer in the process of obtaining objective data. They were apparently satisfied, having produced creativity measure results that were uncontaminated by intelligence factors, that they were measuring differences in creativity and not something else, for no other criterion was used in the study.

Investigations that have employed independent criteria of creativity have frequently used talented subjects whose creative productivity has been determined by peer nomination (MacKinnon, 1962), by supervisor ratings (Taylor, 1961), or from biographical data (Holland, 1961). These studies consistently report little predictive value for tests of any kind. This outcome is not unexpected, however, when the restricted range of ability is considered. McNemar, referring to this situation, bluntly asks, "Why do correlational studies under such adverse circumstances?" (1964, p. 878).

The evidence on the existence of sex differences in performance on creativity tasks is inconclusive. Merrifield (1965), in a review of the literature, reported a study that found girls higher on divergent thinking tests, but lower than boys on tests of convergent thinking. He commented, "This result is consistent with findings of many other investigators". However, Locke (1963), Piers, Daniels, and Quackenbush (1960), and Smith and Neisworth (1966) found sex to be an unimportant variable for most of the measures employed.

The present study

This investigation attempts to avoid some limitations of previous studies in terms of sample selection. It also attempts to determine the degree of independence of several divergent thinking variables, and to compare divergent and convergent thinking tests as predictors of judged creativity and as predictors of academic achievement.

The data were collected under "test" conditions. The research procedures were designed to test these hypotheses:

1. Sex differences in divergent thinking are unimportant.

Two sources of evidence lead to opposite expectations of performance of males and females on tasks of the divergent thinking kind. The first is the frequent finding that females out-perform males on tests that are loaded on verbal factors. If the divergent thinking tests that are used are also verbal, then female superiority would be suggested. The second line of evidence comes from research on behavior in structured compared with unstructured situations. Witkin's work (1962) suggests that the greater "field independence" of male subjects would provide an advantage for males over females in responding to divergent thinking tasks, because minimal structure is offered. The direct evidence on sex differences in divergent thinking is equivocal, but this may be due to the tendency for investigators to use mixed batteries of verbal and non-verbal tests. All divergent thinking tests in the present study are verbal (semantic) in nature, therefore the influences favoring either sex are maximized. Under this condition it was expected that any differential advantages would balance, and that no important sex differences would be found.

2. Divergent thinking tests share more common variance with each other than with conventional measures of convergent thinking.

The question raised here is whether there are two distinct domains of intellectual functioning, represented by conventional ability measures on the one hand, and divergent ability measures on the other. If this difference does, in fact, exist, then there should be found little overlap between the two types of measures, as indicated by low intercorrelations, and by little shared variance on criterion variables. The alternative situation would imply that divergent and convergent thinking tests are simply different means of measuring the same intellectual dimension, in which case the shared variance would be as great between the two methods as it is between the measures of either method.

3. Divergent thinking tests are equivalent measures of a presumed unitary intellectual trait.

Without reference to the degree of independence of divergent thinking tests from convergent thinking tests, which is considered in the previous hypothesis, the interchangeability of divergent thinking tests may be determined. All of the divergent tests used in the present study are semantic in content, therefore homogeneity in factor-structure is more likely than would be the case if non-semantic tests were included. The differences in methods of gathering data (tasks) and in the responses that are scored (fluency, flexibility, cleverness) could conceivably produce evidence of several factors underlying the variables, or, to the contrary, one "divergent-semantic" factor that is assessed in various ways might emerge. An outcome more nearly approaching the latter situation is anticipated, on the basis that a fair degree of intra-individual consistency in behavior is more likely than complete inconsistency, where the criterion behavior is the tendency to make responses. It is also expected that the number of responses produced will be positively correlated with the variety and novelty of the responses, at least to a moderate degree. This relationship has been established in the work of Osborn (1957), and Parnes (1961).

4. Divergent thinking tests are better predictors of creative writing performance than are convergent thinking tests.

It was assumed that the divergent thinking tests would correlate with creative essay writing more closely than would the convergent thinking tests because of the apparent greater number of common elements in the former relationship. In both divergent tests and creative writing tasks responses must be produced by the subject, and a premium is placed upon one or more of the following features of the responses: fluency, flexibility, uncommonness, appropriateness, and transformation of the material. None of these response characteristics is found in conventional tests of convergent thinking. In the latter, the requirement is to select or produce the single response that has been keyed as "correct", given a problem situation.

5. Divergent thinking tests are better predictors of academic course grades than are convergent thinking tests.

The Getzels and Jackson study (1962) is the source of this hypothesis. They reported higher correlations between divergent thinking tests and school achievement than between standard intelligence tests and school achievement. The purpose of the present study is to test the generality of their results.

The present investigation was intended, then, to provide evidence of the degree to which divergent thinking tests are equivalent measures of an intellectual domain that is independent of that measured by conventional aptitude tests; to determine the validity of divergent thinking tests as predictors of judged creative performance and of academic achievement; and to assess the importance of sex differences in divergent thinking.

CHAPTER II

METHOD

Subjects

For the purpose of providing evidence relevant to the hypotheses that guided this study, all students in a General Psychology course were tested, and complete records were obtained for 300 females and 117 males. The sex ratio of the sample is similar to that of the entire institution, which is a New England state college. These students are representative of a wide middle band of college students in general, in terms of socioeconomic status, scholastic aptitude, and secondary school academic record. Highly exceptional individuals, who may be found in numbers in the most selective and unselective colleges, are practically absent from this sample.

Measures

Divergent thinking tasks.

Anagram. The subjects had six minutes to write as many words as they could make out of the test word GENERATION. An example was given to insure that everyone knew the rules of the game.

Plot Titles. Two plots were presented and a total of six minutes allowed for writing of titles. Subjects were encouraged to use their imagination.

Uses. The names of five common objects were given, along with a common and uncommon use for each. The subjects were to list as many additional uses as they could in ten minutes.

Word Meanings. Ten words that have multiple dictionary definitions were exposed at one minute intervals on a screen, the subjects being asked to write as many different meanings as they could for each word. One example was given.

Consequences. Mutation in human structure was described and the subjects were asked to list as many immediate and long-range consequences as they could imagine. Time limit was five minutes.

Creative writing tasks. Two ten minute essays were written in class without advance preparation. The stimulus for the first was a Polaroid reproduction of Thematic Apperception Test card #1, the boy and the violin, which was projected on a large screen. Preceding the picture, these instructions appeared for one minute:

> This is a test of your creative imagination. You shall be shown a picture on the screen and you are to make up a story or plot for which it might be used as an illustration. Tell what led up to this situation, what is being thought or felt, and what will be the outcome. Do your very best. Be creative.

The picture was then shown and remained in view for the entire ten minutes. After the picture appeared the same instructions were given verbally.

The stimulus for the second essay was a brief description of the plot of Hawthorne's story, "The Minister's Black Veil". This had been used by Murray (1938) in studying creative writing ability, those subjects being tested individually in a forty-five minute session. The following instructions, essentially similar to those in that earlier study, were given verbally and repeated once:

> The Minister's Black Veil
>
> This story by Hawthorne is laid in the last century. The central idea is that a minister, after many years with his congregation, appears in the pulpit one Sunday morning wearing a black veil over his face, and thereafter for a long time is never seen without it.
>
> It would be interesting if you would take this idea as the nucleus of a story of your own. You may develop it in any way you please and make any modifications you desire. As your story will be scored on the basis of its literary value you must try to make it as good as possible. You will have ten minutes to write your "short-short" story. Use your imagination!

Convergent thinking tests. Scores were available for all subjects on the Scholastic Aptitude Test (SAT-V and SAT-M).

Academic achievement. Grades in academic subjects and over-all grade point average were obtained from the college Registrar's records. Every student in the sample had completed at least one semester of English Composition, Social Science, Science, Mathematics, and Psychology. The recorded letter grade was used as the measure of achievement. Where mere than one semester course had been completed in a subject, an average grade was determined. Letter grades of A, B, C, D and F were transformed to a five-point numeral scale. The grade point average for three semesters was recorded for each student as the measure of over-all academic achievement.

Procedure

Test administration. The course met three times weekly in three large sections. The investigator had sole responsibility for the lectures during the part of the semester when the tests were administered. On testing days all sections took the same tests. Anagram and TAT were done in one class period, Uses and Word Meanings in another, Plot Titles in a third, and Veil in a fourth period. Total testing time was 57 minutes and total class time required about 75 minutes. There was complete cooperation by the subjects, who informally reported they found the tests "interesting" and "challenging." It was stressed that success in the course was in no way related to performance on the tests. No effort was made to disguise the nature of the tests, and the subjects were urged to use thier imagination in responding.

Scoring of Divergent Thinking tests. Two scores were obtained for each of these tests: Anagram, Plot Titles, Uses, and Consequences. The first score for each was the number of acceptable responses; a measure of fluency or sheer quantity of production, without regard to quality.

The second score for each of these tests was derived in the following way: On the basis of a frequency count the Anagram words were rated for uncommonness on a three point scale. Words found by ten percent or more of the subjects received one point, an additional point was given words found by less than ten percent but more than two percent of the subjects, and a third point was awarded those produced by no more than two percent of the subjects. The sum of these points for all words constituted the Anagram Uncommon score.

Three judges, working independently, rated all of the Plot Titles for cleverness. The titles had been typed on individual strips of index card to remove them from the context of other titles produced by the same subject. They were then placed by the judges in piles of Non-Clever and Clever titles. Five judges now rated the Clever titles for quality on a three-point scale. Each of these titles had already been selected as Clever, so they were all given one point as Clever titles. Agreement among three of the judges was required for final rating as Very Clever (two points), and by two judges for Most Clever rating (three points). Using a check list of titles with quality point ratings assigned, the answer sheets were then scored on a scale of 0-3 for the cleverness of each title. Any title on the answer sheets that was not on the check list of titles rated as Clever, received zero (0) points for quality. The sum of these points for both plots was the subject's Plot Titles Quality Score.

Responses to the Uses test were scored for the number of different classes of use given for each object. Two scorers, using a prepared check sheet, tallied the number of categories represented by the responses to each item. These were summed to provide the Uses Flexibility score.

Consequences was scored the same way as Uses, thus providing a second measure of flexibility. An attempt to rate the responses for immediacy versus remoteness of consequence was abandoned due to lack of rater agreement on differentiating criteria.

Only one score was obtained for Word Meanings when it was found that acceptable responses were almost invariably in different categories of meaning. Some subjects free-associated to the stimulus words, producing numerous responses that could neither be categorized as alternate meanings nor counted as fluency in this context. The single score represents the ability to produce a variety of definitions of words, a measure of Ideational Fluency.

Scoring of Creative Writing samples. Four judges independently read each essay. One male and one female were college instructors of English Composition, the others were a female elementary school teacher and a male Psychologist. The protocols were assembled in batches of approximately one hundred and reading was done at the convenience of the judge, who was asked to read each batch in one sitting, spending no more than one minute on each protocol. This had been found to be sufficient time for reading somewhat longer essays (McColly & Remstad, 1963), and proved ample for these judges. When batches were exchanged the protocols were randomized informally. No marks were made on the papers, ratings being recorded on a separate sheet by code number of the essay, and no judge saw the ratings of any other judge.

The following instructions were given to the judges:

> A four point scale will be used in judging quality. We are not interested in spelling, punctuation, and grammar, except as misuse may obscure meaning. These stories were written in ten minutes, therefore there was little time for correction, much less re-writing.
>
> Essentially we are looking for differences in ability to deal with an ambiguous stimulus in an imaginative way. An important requirement is that a story be told or a plot developed. The time element is also important; past, present, and future must be alluded to.
>
> Since this is considered to be a measure of "creative expression", development of plot and/or character, originality, organization, fluency, humor, surprise, and elaboration provide criteria of quality.
>
> As a basic set of guidelines, the following scoring categories are suggested:[1]

---

[1] This scoring system was used by Meadow and Parnes for assessing the originality of TAT protocols (1959).

1 point---description or bare story
2 points--story with some elaboration of plot and/or character
3 points--same as #2 plus good organization or originality
4 points--story with unusual imaginative elaboration

No suggestion was made concerning frequency distribution of ratings. The judges differed in leniency, and their agreement on the quality of the protocols is expressed by the average inter-rater reliability coefficient of .54, over a range from .48 to .67. The reliability of the summed ratings of all four judges, determined by the Spearman-Brown formula, was .83 for TAT and .82 for Veil.[2]

Data Analysis. The data were entered on IBM cards and the IBM 7040 computer at the University of Connecticut computer center was used for all analyses.

This study utilizes college students as subjects and seeks to determine the relationship between their responses on several tests of divergent thinking and their performance on creative writing tasks. It also seeks to determine the relationship of divergent thinking test performance to college success, as measured by grades in certain academic subjects, and by over-all Grade Point Average. The utility of the SAT-Verbal and SAT-Math tests for predicting both creative writing performance and college grades will be compared with that of the divergent thinking tests. Interrelationships of all of the variables will be determined by analytical statistical methods, including multiple regression procedures and factor analysis.

[2] Increasing the number of judges has the same effect as a proportional increase in the length of a test, (Guilford, 1965, p.466).

CHAPTER III

RESULTS

For convenience and clarity of exposition the results of the investigation are presented in this chapter in five sections, each of which is principally concerned with one of the hypotheses that guided the research.

I. The hypothesis that sex differences in divergent thinking ability are unimportant was investigated by testing the significance of differences between male and female performances on divergent thinking variables, in terms of both mean scores and relative frequency of production of "best" performances.

Table 1 presents data that compares mean performances of males and females on the divergent thinking variables. Sex differences are significant in only one comparison: the females produced more Anagram responses. Use of SAT-V as a covariate, to control for initial sex differences in verbal ability, resulted in one change in the findings of Table 1. Under this condition the males exceeded the females in production of Word Meanings, at the .05 level of significance.

In Table 2 the sex comparison focuses on uncommon rather than average performances. The frequency of males and females as producers of scores above the 10th decile for the total sample is shown. Males

TABLE 1

COMPARISON OF MALE AND FEMALE MEAN SCORES ON DIVERGENT AND CONVERGENT THINKING VARIABLES

Variable	Male		Female		t
	M	SD	M	SD	
Anagram Fluency	25.64	8.77	29.67	7.77	4.85[c]
Anagram Uncommon	3.74	3.20	4.12	3.23	1.08
Plot Titles Fluency	7.47	3.05	7.43	2.89	.07
Plot Titles Quality	1.85	2.57	1.52	1.81	1.24
Uses Fluency	14.58	4.07	14.36	4.60	.48
Uses Quality	13.03	3.60	12.63	3.67	1.01
Consequences Fluency	6.35	2.31	6.41	2.07	.24
Consequences Quality	3.12	1.05	3.11	1.12	.03
Word Meanings	27.77	5.21	27.07	4.27	1.30
SAT-Verbal	469.22	77.91	487.51	77.30	2.15[a]
SAT-Math	496.39	75.96	472.65	74.83	2.85[b]

Note. - SAT-Verbal and SAT-Math are the convergent thinking variables.

df = 415; Male N = 117; Female N = 300

[a] $P < .05$
[b] $P < .01$
[c] $P < .001$

TABLE 2

COMPARISON OF FREQUENCY OF MALE AND FEMALE SCORES ABOVE THE 10TH DECILE OF TOTAL SAMPLE ON DIVERGENT THINKING VARIABLES

Variable	Observed Frequency		χ^2
	Male	Female	
Anagram Fluency	8	34	1.860
Anagram Uncommon	13	29	.116
Plot Titles Fluency	15	27	1.050
Plot Titles Quality	16	26	1.860
Uses Fluency	12	30	.000
Uses Quality	15	27	1.050
Consequences Fluency	13	29	.116
Consequences Quality	11	31	.116
Word Meanings	19	23	5.710*

Note. - Expected frequency Male = 12, Female = 30;

df = 1

* $.05 > p > .01$

are significantly over-represented on Word Meanings and females are under-represented on this variable. No other differences are significant, including that for Anagram Fluency.

In these results the sexes do not differ significantly either in average performance or in production of the best performances, except for the Anagram Fluency and Word Meanings variables. With these restrictions, then, the hypothesis, that any sex differences in divergent thinking are unimportant, may be accepted.

II. The hypothesis that _divergent thinking tests share more common variance with each other than with conventional measures of convergent thinking_ was investigated by subjective examination of inter-correlations between the variables, by factor analysis, and by multiple regression analysis.

This hypothesis postulated the independence of divergent thinking scores from conventional convergent thinking scores. One way of demonstrating this situation would be to show clustering of inter-correlated variables in two discrete groups, with high correlations within but low correlations between the groups. Another method would be to factor-analyze the correlation matrix and show low common-factor loadings and high unique-factor loadings for the two kinds of tests. A third approach would be to demonstrate that specific criteria would be predicted significantly more accurately when the two kinds of tests were combined as predictors than when either type of test is used alone. This last method would, by using a criterion, provide evidence of shared factors in the predictors. In this situation, the use of several different criteria would have the added advantage of permitting evaluation of the predictive validity of divergent thinking variables, a matter on which there is little information. The results of the subjective cluster analysis, factor analysis, and multiple regression methods of examining evidence pertinent to the hypothesis are described in the following sections.

(a) Subjective cluster analysis

The clustering of interrelated divergent and convergent thinking variables in the total sample is shown in Table 3. Cluster A consists exclusively of divergent thinking (DT) variables, and triangle B is a cluster of certain DT and convergent thinking (CT) variables. Word Meanings is the key variable that ties clusters A and B together. It belongs with A as well as B, but was separated from the former in order to show clearly the clustering of triangle B. Plot Titles Quality is more closely associated with the variables of cluster A than with those of cluster B.

Among cluster A variables, only Consequences Fluency correlates with any cluster B variable at the .01 level of significance. Thus there are two clearly defined groups of variables. In addition there is one variable that belongs with both groups and one that is mainly associated with cluster A.

In Tables 4 and 5 analysis of the male and female sample intercorrelations reveals a cluster of variables identical to cluster A of Table 3. Word Meanings correlates with all variables except Plot Titles in the female sample, and is just short of significant correlation with SAT-M in the male sample.

TABLE 3

INTERCORRELATIONS OF DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES FOR TOTAL SAMPLE, ARRANGED TO SHOW CLUSTERS

(N = 417)

		1	2	3	4	5	6	7	8	9	10
Plot Titles Fluency	1										
Uses Fluency	2	40		Cluster A							
Uses Flexibility	3	37	93								
Consequences Fluency	4	31	37	35							
Consequences Flexibility	5	17	24	23	54						
Plot Titles Quality	6	16	11	17	17	08					
Word Meanings	7	20	30	31	29	16	13				
Anagram Uncommon	8	11	08	10	10	08	15	27		Cluster B	
Anagram Fluency	9	07	02	03	17	10	09	21	62		
SAT-V	10	-01	05	08	14	10	08	41	20	13	
SAT-M	11	-06	01	01	10	09	06	19	17	17	33

Note. - Decimals are omitted. Correlations of .10 and .13 are required for significance at the .05 and .01 levels, respectively.

SAT-V and SAT-M are the convergent thinking variables.

TABLE 4

INTERCORRELATIONS OF DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES FOR MALE SAMPLE, ARRANGED TO SHOW CLUSTERS

(N = 117)

		1	2	3	4	5	6	7	8	9	10
Plot Titles Fluency	1										
Uses Fluency	2	45		Cluster A							
Uses Flexibility	3	40	93								
Consequences Fluency	4	35	41	42							
Consequences Flexibility	5	29	32	35	54						
Plot Titles Quality	6	14	17	23	27	08					
Word Meanings	7	29	33	34	35	24	21				
Anagram Uncommon	8	15	05	07	13	05	27	37		Cluster B	
Anagram Fluency	9	14	06	08	18	04	22	34	69		
SAT-V	10	01	01	04	22	15	09	47	21	21	
SAT-M	11	-10	03	02	00	14	04	17	09	12	28

Note. - Decimals are omitted. Correlations of .18 and .24 are required for significance at the .05 and .01 levels, respectively.

SAT-V and SAT-M are the convergent thinking variables.

TABLE 5

INTERCORRELATIONS OF DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES FOR FEMALE SAMPLE, ARRANGED TO SHOW CLUSTERS

(N = 300)

		1	2	3	4	5	6	7	8	9	10
Plot Titles Fluency	1										
Uses Fluency	2	38		Cluster A							
Uses Flexibility	3	36	93								
Consequences Fluency	4	28	36	33							
Consequences Flexibility	5	12	22	19	55						
Plot Titles Quality	6	17	09	15	12	09					
SAT-V	7	-02	07	10	10	08	10				
Word Meanings	8	16	29	30	26	13	07	39		Cluster B	
Anagram Uncommon	9	09	10	11	09	10	09	17	23		
SAT-M	10	-04	-04	00	15	07	07	37	20	22	
Anagram Fluency	11	04	02	03	17	12	04	06	17	60	24

Note. - Decimals are omitted. Correlations of .11 and .15 are required for significance at the .05 and .01 levels, respectively.

SAT-V and SAT-M are the convergent thinking variables.

Cluster B consists of two overlapping groups of variables in both male and female samples. Its composition differs, however, in the two sexes. The basic difference is in the roles of Plot Titles Quality and SAT-M. In Table 4, Plot Titles is one of the B sub-clusters, and SAT-M is not included. Table 5, for the female sample, shows the reverse of that situation.

Essentially, the Anagram measures are consistently more closely related to the CT than to the DT variables, while the remaining DT variables are more related to each other, with the exception of Word Meanings and, in the male sample only, Plot Titles. The hypothesis receives support in the sense that homogeneous divergent thinking variables that are practically unrelated to convergent thinking ability may be found. However, it may not be assumed that any task that encourages the production of divergent responses belongs with the DT group more than with CT variables.

(b) Factor analysis

In order to provide more objective evidence on the relationship of divergent thinking variables to each other and to convergent thinking measures, a formal factor analysis was undertaken. The computer program performed a Principal Components factor analysis, and also a Varimax rotation of the principal axes. Complete data resulting from both procedures appears in the Appendix. The abbreviated material that constitutes Tables 6, 7, and 8 in this section presents only those factor loadings that exceed .300, in order to show most clearly the pattern of "significant" factor loadings. The .300 criterion was chosen as the lowest level for inclusion of loadings of variables

TABLE 6

PRINCIPAL FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE TOTAL SAMPLE

(N = 417)

	Factors					
Variable	I	II	III	IV	V	VI
Uses Flexibility	761	-438		-318		
Uses Fluency	754	-470				
Consequences Fluency	671			515		
Word Meanings	606					416
Plot Titles Fluency	531					341
Consequences Flexibility	509			689		
Anagram Uncommon	410	618	-491			
Anagram Fluency	356	619	-510			
SAT-V	343	488	517			
Plot Titles Quality	325				-911	
SAT-M		504	447			-529

Note. - Only loadings greater than .300 are included and the decimal points have been omitted.

The six components account for 81.1 per cent of the total variance in the battery of eleven variables.

TABLE 7

PRINCIPAL FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE MALE SAMPLE

(N = 117)

	Factors					
Variable	I	II	III	IV	V	VI
Uses Flexibility	747	-469		377		
Uses Fluency	731	-499		392		
Consequences Fluency	698			-462		
Word Meanings	680	305				346
Plot Titles Fluency	579					
Consequences Flexibility	557		391	-454		-349
Anagram Uncommon	450	672	-363			
Anagram Fluency	445	637	-359			-314
Plot Titles Quality	413		-303		-782	
SAT-V	374	503	498			436
SAT-M		325	622	429		-394

Note. - Only loadings greater than .300 are included and the decimal points have been omitted.

The six components account for 83.7 per cent of the total variance in the battery of eleven variables.

TABLE 8

PRINCIPAL FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE FEMALE SAMPLE

(N = 300)

Variable	Factors				
	I	II	III	IV	V
Uses Flexibility	766	-433			
Uses Fluency	764	-467			
Consequences Fluency	655			545	
Word Meanings	573		-375		
Plot Titles Fluency	505	-317			
Consequences Flexibility	488			698	
Anagram Uncommon	404	589	387	-360	
SAT-V	341	451	-649		
Anagram Fluency	340	612	526		
Plot Titles Quality					-915
SAT-M		599	-302		

Note. - Only loadings greater than .300 are included and the decimal points have been omitted.

The five components account for 65.4 per cent of the total variance in the battery of eleven variables.

on the factors because of its wide acceptance as a fair estimate of significance. There are no exact statistics that delineate the error distribution of factor loadings; therefore a "rule-of-thumb" procedure is generally followed. Consideration was given to the method advanced by Harman (1960, p. 177) in which the average intercorrelation of the variables as well as the sample N are involved in producing an estimate of the standard error of factor loadings. But Harman's method was judged to be too lenient when it was found that, for the total sample N of 417, with an average intercorrelation of .19, loadings of as small a value as .180 would be significant at the .05 level.

In view of the present intention of merely displaying the differentiated factor patterns in a convenient form, it was decided that the risk of an error of the second kind would be the better choice.

Comparison of Tables 6, 7, and 8 with Tables 3, 4, and 5 reveals the commensurate relations of the formal factor analyses with the more subjective "correlation cluster inspection" approach. In Tables 6, 7, and 8 the rank order of the first seven variables for loading on Factor I is identical in all samples, and includes the five variables that constitute Cluster A of Tables 3, 4, and 5. Word Meanings is again seen to be closely related to the "cluster A" variables, while Anagrams, as well as the SATs, show low relationship with the remaining variables.

The Varimax Factor Patterns shown in Tables 9, 10, and 11 represent the "simplest" factor structure of the DT and CT variables, and result from the rotation of the principal axes to planes that are maximally

TABLE 9

VARIMAX FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE TOTAL SAMPLE

(N = 417)

Variable	Factors I	II	III	IV
Uses Fluency	927			
Uses Flexibility	925			
Plot Titles Fluency	583			
Word Meanings	383		599	
Consequences Fluency	307			794
Anagram Fluency		880		
Anagram Uncommon		874		
SAT-V			830	
SAT-M			689	
Consequences Flexibility				886
Plot Titles Quality*				

Note. - Only loadings greater than .300 are included and the decimal points have been dropped.

* This variable has no loading above .300.

TABLE 10

VARIMAX FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE MALE SAMPLE

(N = 117)

Variable	Factors I	Factors II	Factors III
Uses Fluency	885		
Uses Flexibility	881		
Consequences Fluency	666		
Plot Titles Fluency	627		
Consequences Flexibility	590		393
Word Meanings	394	452	467
Anagram Uncommon		876	
Anagram Fluency		847	
Plot Titles Quality		479	
SAT-V			758
SAT-M			717

Note. - Only loadings greater than .300 are included and the decimal points have been dropped.

TABLE 11

VARIMAX FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE FEMALE SAMPLE

(N = 300)

	Factors			
Variable	I	II	III	IV
Uses Fluency	925			
Uses Flexibility	923			
Plot Titles Fluency	595			
Word Meanings	365		618	
Consequences Fluency	300			809
Anagram Fluency		889		
Anagram Uncommon		863		
SAT-V			862	
SAT-M			667	
Consequences Flexibility				884
Plot Titles Quality*				

Note. - Only loadings greater than .300 are included and the decimal points have been dropped.

* This variable has no loading above .300.

independent. In the male sample the ubiquitous character of Word Meanings is again shown, for it has loadings on all three factors. The Anagram variables share common variance only with Plot Titles Quality, while Factors II and III replicate the relationships shown in Cluster B of Table 4.

The Varimax Factor Pattern for the female sample shows similar variables included in Factor I as in the male sample, with the single exception of Consequences Flexibility, which, however, is linked to the Factor I variables through its relationship with Consequences Fluency, as seen in Factor IV.

The Anagram variables are clearly segregated from all others in Factor II in the female sample, which is a departure from the male situation. The SATs are again related to Word Meanings, as in the male sample. Plot Titles has a different role in the female sample, where it fails to appear with significant loading on any factor. This exceptional character of Plot Titles Quality was noted in the cluster inspection, but is more clearly revealed in the present factor analysis.

It may be noted that, had the more stringent significance level of .400 been required for inclusion of loadings that represent a factor (a level that is favored by some factor analysts), the Varimax rotations reveal perfect "simple structure" in the female sample, with no overlap of variables and factors. Factor I is then composed of Plot Titles Fluency and the Uses variables, Factor II is the Anagram scores, Factor III is Word Meanings plus both SATs, and Factor IV is the Consequences variables. Plot Titles Quality, of course, is still outside this structure.

With the use of the same criterion, the male sample would have perfect "simple structure", with the exception of Word Meanings, which would still load on two factors.

The sex differences in factor pattern are not great, whether the required level of significance for factor loadings is placed at .300 or .400, but it may be observed that the female sample tends to show more differentiation than does the male sample, since the variance is distributed among four rotated factors in the former group, and among only three in the case of the males. In both sexes the rotated factor patterns demonstrate approximately equal "simple structure", but, with the difference in number of underlying factors to which variance may be apportioned, the female sample appears to be more complex.

It may be concluded, then, that the hypothesis, which postulated that divergent thinking variables are independent of convergent thinking variables, receives support from the present factor analysis, with the same restrictions that accompanied the "cluster inspection" of the preceding section:

(1) Anagram does not "belong" with the divergent thinking group of variables because the Anagram Fluency and Flexibility scores, while fitting the requirement of being emitted responses, show little in the way of common variance with the other DT variables, and, in fact, correlate better with convergent thinking tests of the SAT kind.

(2) Plot Titles Quality, while apparently well-qualified as a divergent thinking variable on the basis of face validity, shares little common variance with the rest of the divergent thinking variables.

(c) Multiple regression analysis

Evidence of the relative independence of DT and Ct variables is further shown in Tables 16, 17, and 24. In Tables 16 and 17 the prediction of creative writing performance is significantly better when DT and CT variables are combined as multiple predictors, than when either set is used alone. This provides evidence of significant unshared variance in the two sets of variables. In the prediction of academic performance (Table 24), only Social Science grade is predicted better by a similar combination of DT and CT variables than by the CT set alone. For these academic criteria the DT variables account for very little variance, whether used by themselves or combined with CT variables.

The degree to which DT variables are relatively independent of CT variables depends upon the criteria used. The amount of shared variance is substantial in creative writing, but generally insignificant in course grades.

On the basis of the evidence that has been examined, the present hypothesis may be given qualified acceptance. Several DT variables have been found to share more common variance with each other than with CT measures, but not all of the DT variables may be included in this group. For example, Plot Titles Quality, a variable with good face validity as a DT measure, is inconsistently related with the other DT variables. This finding is reason to use caution in treating divergent thinking variables as if they were equivalent and interchangeable measures of a homogeneous ability.

III. The hypothesis that divergent thinking tests are equivalent measures of a presumed unitary intellectual trait was evaluated by observation of intercorrelations of the variables, factor analysis, and by determination of trait-method relationships.

In contrast with the preceding hypothesis, the present hypothesis focused on the divergent thinking variables alone and proposed that they were univocal, that is, were equivalent measures of a unitary trait. If so, these variables could be summed to form a composite, and the more easily obtained data could be used for economy. A single composite measure of this kind would have the advantage of good reliability and usability. Whether the predictive validity of the composite would be enhanced over that of the components would have to be determined in specific situations.

The subjective cluster analysis method used in evaluating the preceding hypothesis provides some information pertinent to the present concern. There it was shown that the divergent thinking variables were not univocal, but that a group of six variables formed a cluster of significantly related elements. Both Uses scores, both Consequences scores, Plot Titles Fluency, and Word Meanings comprised the cluster. In order to make the more detailed analysis required for evaluating the present hypothesis this study adapted the Method-Trait paradigm introduced by Campbell and Fiske (1959).

The Campbell and Fiske technique requires at least two methods of measuring two or more traits in order to determine whether trait measures are independent of methods of measurement. With the exception of Word Meanings, the divergent thinking tests yielded two scores, one a measure of Fluency, the other a measure of production of diverse and uncommon responses. In this section, for convenience, the latter will be called the Quality score. Each test is a method of measuring divergent thinking, and the two scores may be considered as traits of the operant mode of responding. Table 12 presents the data for the total sample. Tables 13 and 14 present the data for males and females respectively.

In all three tables the diagonal entries in italics show the common method-different trait correlations; that is, the cross correlations that result when the two traits are measured by the same method. Only in the case of Plot Titles (A2-B2) is any correlation below the .05 level of significance. For the other variables the inter-trait correlations are higher than any other relationships in the matrices, which is an indication that scores for Quantity and Quality are not independent. In practical terms, the prediction of any Quality score is better by use of its companion Fluency score than by any other Quality score.

The squares (quads) contain hetero-trait, hetero-method entries. In each quad the upper-left and lower-right values are common trait-different method correlations, while the lower-left and upper-right entries are different trait-different method correlations.

Where the upper-left and lower-right correlations within a quad are higher than the lower-left and upper-right pair, the traits are being measured relatively independently of the methods. Inspection of

TABLE 12

METHOD-TRAIT RELATIONSHIPS FOR TOTAL SAMPLE

(N = 417)

		Method 1		Method 2		Method 3		Method 4	
		A1	B1	A2	B2	A3	B3	A4	B4
Method 1 (Anagram)	A1								
	B1	62							
Method 2 (Plot Titles)	A2	07	11						
	B2	09	15	16					
Method 3 (Uses)	A3	02	08	40	11				
	B3	03	10	37	17	93			
Method 4 (Consequences)	A4	17	10	31	17	37	35		
	B4	10	08	17	08	24	23	54	

Note. - Decimals are omitted. $p < .05$ and $p < .01$ require correlations of .10 and .13 respectively.

Trait A is Fluency, Trait B is Quality.

TABLE 13

METHOD-TRAIT RELATIONSHIPS FOR MALE SAMPLE

(N = 117)

		Method 1		Method 2		Method 3		Method 4	
		A1	B1	A2	B2	A3	B3	A4	B4
Method 1 (Anagram)	A1								
	B1	69							
Method 2 (Plot Titles)	A2	14	15						
	B2	22	27	14					
Method 3 (Uses)	A3	06	05	45	17				
	B3	08	07	40	23	93			
Method 4 (Consequences)	A4	18	13	35	27	41	42		
	B4	04	05	29	08	32	35	54	

Note. - Decimals are omitted. $p < .05$ and $p < .01$ require correlations of .18 and .24 respectively.
Trait A is Fluency, Trait B is Quality.

TABLE 14

METHOD-TRAIT RELATIONSHIPS FOR FEMALE SAMPLE

(N = 300)

		Method 1		Method 2		Method 3		Method 4	
		A1	B1	A2	B2	A3	B3	A4	B4
Method 1 (Anagram)	A1								
	B1	60							
Method 2 (Plot Titles)	A2	04	09						
	B2	04	09	17					
Method 3 (Uses)	A3	02	10	38	09				
	B3	03	11	36	15	93			
Method 4 (Consequences)	A4	17	09	28	12	36	33		
	B4	12	10	12	09	22	19	55	

Note. - Decimals are omitted. $p < .05$ and $p < .01$ require correlations of .11 and .15 respectively.

Trait A is Fluency, Trait B is Quality.

the quads provides further evidence of the lack of independence between traits and methods, because there is no consistent pattern of the kind required.

Method 1, Anagram, is again seen to be poorly related to the other variables. Fluency scores are consistently correlated between Methods 2, 3, and 4, while Quality inter-correlations are lower and more heterogeneous. This suggests that the former may be treated as equivalent measures of a unitary trait; the tendency to produce numerous responses. The low and varied correlations between the Quality variables do not, however, provide evidence of a general trait.

This finding is significant because it suggests that individual differences in divergent thinking ability may be more closely related to a general disposition to emit responses than to a general tendency to produce novelty and variety in responses. Differences in reliability of fluency and quality scores have to be taken into account, however, before such a characterization could be established.

The commensurate patterns of correlations in Tables 13 and 14 indicate that the sexes do not differ appreciably, and the findings from the total sample apply equally to males and females.

The Varimax factor pattern of Tables 9, 10, and 11 provide additional evidence of the unitary nature of the divergent thinking variables. Only the Anagram measures and Plot Titles Quality fail to conform to the basic factor pattern that underlies the remaining DT variables.

In summary, it was found that Methods 2, 3, and 4 (Plot Titles, Uses, and Consequences) are relatively equivalent vehicles for measuring divergent thinking. To this group may be added Word Meanings, on the basis of the evidence in Table 3. Anagram may be excluded from this set because of its unrelatedness. The response modes (traits) are not independent of each other nor of method of measuring divergent thinking. Response quantity (fluency) is more like a general trait than is response quality (novelty and variety of responses). In this context, and with the restrictions noted, the hypothesis that divergent thinking tests are equivalent measures of a presumed unitary intellectual trait may be accepted.

IV. The hypothesis that divergent thinking tests are better predictors of creative writing performance than are convergent thinking tests was investigated by means of bivariate and multivariate regression methods.

On the basis of a comparison of individual divergent thinking and convergent thinking variables as predictors of creative writing performance, this hypothesis appears to be without support. The bivariate relationships shown in Table 15 indicate that SAT-V is generally equal or superior to the divergent thinking variables as a predictor of imaginative essay writing performance. SAT-M, the other convergent thinking variable, is clearly inferior as a predictor in the female sample, but is as useful as several divergent thinking variables in the male sample. Of the convergent thinking tests SAT-V is, of course, the one that would normally be used as a predictor in this situation.

Since the Scholastic Aptitude Tests are each composites of highly related content, and the divergent thinking variables are brief samples

TABLE 15

CORRELATION COEFFICIENTS BETWEEN DIVERGENT AND CONVERGENT THINKING SCORES AND ESSAY TOTAL SCORE

Predictors	Male Sample[a]	Female Sample[b]	Total Sample[c]
Divergent Thinking Tests			
Anagram Fluency	.16	.09	.12 *
Anagram Uncommon	.15	.18 **	.18 **
Plot Titles Fluency	.14	.16 **	.15 **
Plot Titles Quality	.25 **	.12 *	.16 **
Uses Fluency	.19 *	.15 **	.16 **
Uses Flexibility	.25 **	.21 **	.22 **
Consequences Fluency	.17	.25 **	.22 **
Consequences Flexibility	.24 **	.17 **	.19 **
Word Meanings	.24 **	.23 **	.23 **
Convergent Thinking Tests			
SAT-Verbal	.28 **	.22 **	.24 **
SAT-Math	.16	-.01	.03

Note. - * p .05

** p .01

[a]N = 117

[b]N = 300

[c]N = 417

of verbal operant behavior, a comparison was made between combined divergent thinking and convergent thinking variables as teamed predictors. Instead of forming a single composite score from the former variables, the multiple regression method was used. In this way the maximum predictive power of the two sets of variables could be compared without concern for homogeneity of content of either set.

Table 16 is oriented to the SATs as the basic predictor combination, and shows the effect of adding all nine divergent thinking scores to the predictor team. The difference is highly significant for total and female samples, where p exceeds .001. The difference fails to reach the .05 level of significance in the male sample.

Table 17 treats the divergent thinking combination as the basic unit, and shows the effect of adding the SAT scores to the team. This result is also significant in the total and female samples, but again fails to reach the .05 level in the male sample. With female subjects, it clearly pays in increased prediction accuracy to combine the two sets of variables.

Table 18 combines the multiple correlation data from Tables 16 and 17, and adds (in the parentheses) the values that are unbiased estimates of the multiple correlation in the population. The uncorrected multiple correlation coefficient represents the maximum correlation between weighted predictors and the criterion, and incorporates any chance deviations that favor high multiple correlation. In order to generalize beyond the present sample a correction for this

TABLE 16

EFFECT ON PREDICTION OF CREATIVE WRITING PERFORMANCE OF ADDING NINE DIVERGENT THINKING VARIABLES TO A TEAM OF TWO CONVERGENT THINKING VARIABLES

Criterion Group	Multiple Correlations			
	DT + CT	CT	F	p
Total Sample (N = 417)	.403	.247	5.46^a	$<.001$
Female Sample (N = 300)	.429	.253	4.71^b	$<.001$
Male Sample (N = 117)	.454	.289	1.79^c	$>.05$

Note. - [a] $df_1 = 9$, $df_2 = 405$
[b] $df_1 = 9$, $df_2 = 288$
[c] $df_1 = 9$, $df_2 = 105$

DT variables are Anagram Fluency and Uncommon, Plot Titles Fluency and Quality, Uses Fluency and Flexibility, Consequences Fluency and Flexibility, and Word Meanings.

CT variables are SAT-Verbal and SAT-Math.

TABLE 17

EFFECT ON PREDICTION OF CREATIVE WRITING PERFORMANCE OF ADDING TWO CONVERGENT THINKING VARIABLES TO A TEAM OF NINE DIVERGENT THINKING VARIABLES

Criterion Group		Multiple Correlations			
		DT + CT	DT	F	p
Total Sample	(N = 417)	.403	.367	6.75[a]	$<.01$
Female Sample	(N = 300)	.429	.384	6.48[b]	$<.01$
Male Sample	(N = 117)	.454	.399	3.07[c]	$>.05$

Note. - [a] $df_1 = 2$, $df_2 = 405$

[b] $df_1 = 2$, $df_2 = 288$

[c] $df_1 = 2$, $df_2 = 105$

DT variables are Anagram Fluency and Uncommon, Plot Titles Fluency and Quality, Uses Fluency and Flexibility, Consequences Fluency and Flexibility, and Word Meanings.

CT variables are SAT-Verbal and SAT-Math.

TABLE 18

UNBIASED ESTIMATES OF THE CORRELATION BETWEEN THREE PREDICTOR TEAMS AND CREATIVE WRITING PERFORMANCE

Criterion Group	Multiple Correlations		
	Eleven [a] Predictors	Nine [b] Predictors	Two [c] Predictors
Total Sample (N = 417)	403 (374)	367 (340)	247
Male Sample (N = 117)	454 (350)	399 (298)	289
Female Sample (N = 300)	429 (391)	384 (348)	253

Note. - Decimals have been omitted.

The correlation coefficients in the parentheses are the (unbiased) values of the multiple correlations after correction for shrinkage.

[a] Nine DT variables plus SAT-V and SAT-M

[b] DT variables only

[c] SAT-V and SAT-M

bias is required. In the case of two predictors the bias is negligible. Considerable inflation of the multiple correlation coefficient results, however, as the number of variables correlated (m) approaches the number of cases in the sample (N). When m equals N, R equals +1.00, regardless of the parameter value ($\bar{R}$).[3]

In Table 18 the relationship of number of variables to sample size may be seen clearly by comparing the inflated values of R with the "shrunken" values. For example, in the total sample, where N=417, eleven predictors have a corrected multiple correlation that is about .03 lower than the uncorrected coefficient. In the male sample, where N=117, the same eleven predictors have a corrected R that is about .10 lower than the uncorrected value.

A means of comparing the predictive power of the DT and CT variables is to compare the proportion of variance in Essay total scores that is accounted for by each of the predictor teams. In Tables 19, 20, and 21 the squared multiple correlation coefficients provide this information. The DT variables as a team have about twice the prediction power of the CT tests in all three samples. Modest as the relationships are, the validity of the divergent thinking variables as measures of creativity is nevertheless greater than that of a convergent thinking test like SAT.

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[3] Guilford (1965, p. 401) provides the following formula for "shrinking" R (the multiple correlation coefficient) to a more probable population value:

$$_cR^2 = 1 - (1-R^2)\ \frac{N-1}{N-m}$$

Where N = number of cases in the sample correlated, m = number of variables correlated. N-m = number of degrees of freedom, one degree being lost for each mean, there being one mean per variable.

The Beta r column entries of Tables 19, 20, and 21 show the proportion of variance in the criterion accounted for by each variable. These are weighted values, and take into account the relationship among the predictors.[4] The divergent thinking variables are seen to have similar weighting in the DT and in the DT + CT combinations of predictors. The only exception is Word Meanings, which has a diminished role in the latter instance, due to its overlap with SAT-V.

That the other DT variables do not change in weighted contribution to the multiple prediction when teamed with the SATs is an indication of their relative independence of (lack of common variance with) the SATs when the criterion is imaginative essay writing. This degree of independence accounts for the significant improvement in multiple prediction for the female sample when DT and CT variables are combined. The failure of the male sample to show commensurate improvement is apparently due to the closer three-way relationship between Word Meanings, SATs, and Essay score in the male sample as compared with the female sample.

The most direct evidence in support of this explanation is seen in Tables 20 and 21. The amount of reduction in Beta weight of Word Meanings (DT + CT column compared with DT column) indicates the

[4] The product of the Beta weight of a predictor and the correlation between that variable and the criterion is a measure of the proportion of variance in the criterion that is accounted for by the predictor. The sum of the Beta r values equals R^2, the coefficient of determination. Each Beta r indicates the relative contribution of the variable, as a member of the prediction team, to the reduction of variance on the criterion.

TABLE 19

PROPORTION OF VARIANCE IN TOTAL SAMPLE ESSAY SCORES PREDICTED BY DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES

(N = 417)

Predictors	Beta r Weights		
	DT + CT	DT	CT
Anagram Fluency	.0001	-.0015	
Anagram Uncommon	.0167	.0195	
Plot Titles Fluency	.0085	.0070	
Plot Titles Quality	.0101	.0105	
Uses Fluency	-.0548	-.0555	
Uses Flexibility	.0909	.0905	
Consequences Fluency	.0188	.0201	
Consequences Flexibility	.0169	.0171	
Word Meanings	.0135	.0270	
SAT-V	.0445		.0646
SAT-M	-.0026		-.0037
Multiple Correlation squared	.1626	.1347	.0609
Multiple Correlation	.403	.367	.247

TABLE 20

PROPORTION OF VARIANCE IN MALE SAMPLE ESSAY SCORES PREDICTED BY DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES

(N = 117)

Predictors	Beta r Weights		
	DT + CT	DT	CT
Anagram Fluency	.0125	.0120	
Anagram Uncommon	-.0055	-.0004	
Plot Titles Fluency	.0081	.0026	
Plot Titles Quality	.0457	.0442	
Uses Fluency	-.0414	-.0450	
Uses Flexibility	.0911	.0869	
Consequences Fluency	-.0185	-.0147	
Consequences Flexibility	.0402	.0468	
Word Meanings	-.0020	.0271	
SAT-V	.0652		.0714
SAT-M	.0106		.0121
Multiple Correlation squared	.2060	.1595	.0835
Multiple Correlation	.454	.399	.289

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TABLE 21

PROPORTION OF VARIANCE IN FEMALE SAMPLE ESSAY SCORES PREDICTED BY DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES

(N = 300)

	Beta r Weights		
Predictors	DT + CT	DT	CT
Anagram Fluency	-.0026	-.0061	
Anagram Uncommon	.0261	.0273	
Plot Titles Fluency	.0098	.0089	
Plot Titles Quality	.0038	.0047	
Uses Fluency	-.0660	-.0620	
Uses Flexibility	.0977	.0946	
Consequences Fluency	.0449	.0400	
Consequences Flexibility	.0079	.0094	
Word Meanings	.0205	.0308	
SAT-V	.0402		.0551
SAT-M	.0017		.0091
Multiple Correlation squared	.1843	.1476	.0642
Multiple Correlation	.429	.384	.253

effective amount of shared variance between Word Meanings and the SATs; the reduction is much greater in the male than the female sample.

Holding aside such considerations as ease of administration and scoring, availability of normative data, reliability, objectivity, and usability, then the better choice for prediction of creativity as evaluated here would be the divergent thinking variables. It is also evident that a combination of SAT-V and DT variables produces both statistical and practical improvement in prediction over the use of either separately. Under the condition of multiple prediction, then, the hypothesis, that divergent thinking tests are better predictors of creative writing performance than are convergent thinking tests may be accepted.

V. The hypothesis that divergent thinking tests are better predictors of academic course grades than are convergent thinking tests was evaluated by means of bivariate and multivariate regression methods.

This hypothesis was suggested by the findings of Getzels and Jackson (1962). Three out of five of their creativity tests correlated higher with verbal-content school achievement than did intelligence tests. Table 22 presents the individual correlation coefficients between predictors and criterion variables. Only Word Meanings approaches either SAT-V or SAT-M for statistical significance as a predictor of academic achievement. SAT-V is the best predictor for all but Science and Mathematics. For Science SAT-M is equal to SAT-V, and for Math it is superior. Word Meanings is the most consistent divergent thinking predictor, but is not significantly better than SAT-M as a

TABLE 22

CORRELATION COEFFICIENTS BETWEEN DIVERGENT AND CONVERGENT THINKING SCORES AND ACADEMIC ACHIEVEMENT FOR TOTAL SAMPLE

(N = 417; decimals are omitted)

	Achievement Criteria†					
Divergent Thinking Variables	E	SS	S	M	P	GPA
Anagram Fluency	14**	05	07	11*	04	08
Anagram Uncommon	11*	12	08	06	06	13**
Plot Titles Fluency	00	10*	08	00	-03	08
Plot Titles Quality	07	-05	01	-05	-02	02
Uses Fluency	-03	07	03	-05	00	06
Uses Flexibility	01	09	03	-04	01	08
Consequences Fluency	05	14**	07	07	06	12*
Consequences Flexibility	05	11*	08	04	06	11*
Word Meanings	13**	26**	17**	04	13**	21**
Convergent Thinking Variables						
SAT-Verbal	39**	43**	29**	15**	40**	42**
SAT-Math	17**	21**	30**	46**	25**	31**

Note. - *p .05
**p .01

†Achievement Criteria

E - English	M - Mathematics
SS - Social Science	P - Psychology
S - Science	GPA - Grade Point Average

predictor of any academic criterion.

The DT variables were teamed as multiple predictors of the achievement variables, for comparison with the CT tests. Also the DT and CT variables were combined in order to determine maximum predictive power of the entire "battery". The results are shown in Tables 23 and 24.

In Table 23 it is seen that the combined DT and CT variables are superior to the pair of CT variables as predictors in only one case: Social Science. Table 24 shows that highly significant results follow the addition of the CT variables to the DT variables. Comparison of the CT variables in Table 23 with the DT variables in Table 24 shows that the maximum predictive power of the DT variables as a team is less than that of the CT tests.

Table 25 permits direct comparison of the predictive efficiency of the various combinations of variables. The squared multiple correlation coefficients represent the proportion of variance in the criterion variables that is accounted for by the predictor teams. The CT combination is a better predictor than the DT combination in every case, by factors ranging from 2 in Social Science, to 7 in Mathematics. The difference between proportions of variance explained by the two sets of predictors is significant beyond the .01 level in all cases. It may be noted that small practical advantage is gained by adding all nine DT variables to the two CT tests. Even for Social Science, where the gain is statistically significant, the actual improvement in predictive efficiency is only 3.5 percent, as measured by the reduction in variance on the criterion.

It therefore appears that the conventional SAT-V and SAT-M are

TABLE 23

EFFECT ON PREDICTION OF ACADEMIC PERFORMANCE OF ADDING NINE DIVERGENT THINKING VARIABLES TO A TEAM OF TWO CONVERGENT THINKING VARIABLES

(Total Sample; $N = 417$

Criterion	Multiple Correlations		F	p
	DT + CT	CT		
English	.418	.392	1.16	ns
Social Science	.475	.436	2.06	$.05 > p > .01$
Science	.380	.366	.56	ns
Mathematics	.482	.460	1.18	ns
Psychology	.429	.419	.49	ns
Grade Point Average	.471	.456	.75	ns

Note. - $df_1 = 9$, $df_2 = 405$

DT variables are Anagram Fluency and Uncommon, Plot Titles Fluency and Quality, Uses Fluency and Flexibility, Consequences Fluency and Flexibility, and Word Meanings.

CT variables are SAT-Verbal and SAT-Math.

TABLE 24

EFFECT ON PREDICTION OF ACADEMIC PERFORMANCE OF ADDING TWO CONVERGENT THINKING VARIABLES TO A TEAM OF NINE DIVERGENT THINKING VARIABLES

(Total Sample; N = 417)

Criterion	Multiple Correlations		F	p
	DT + CT	DT		
English	.418	.214	31	$<.001$
Social Science	.475	.310	33	$<.001$
Science	.380	.194	25	$<.001$
Mathematics	.482	.168	54	$<.001$
Psychology	.429	.164	39	$<.001$
Grade Point Average	.471	.245	42	$<.001$

Note. - $df_1 = 2$, $df_2 = 405$. An F value of approximately 3.3 is required for significance at the .001 level.

DT variables are Anagram Fluency and Uncommon, Plot Titles Fluency and Quality, Uses Fluency and Flexibility, Consequences Fluency and Flexibility, and Word Meanings.

CT variables are SAT-Verbal and SAT-Math.

TABLE 25

PROPORTION OF THE VARIANCE IN CRITERION VARIABLES PREDICTED BY TEAMS OF DIVERVENT THINKING AND CONVERGENT THINKING VARIABLES

Criterion	Predictor R^2		
	DT + CT	DT	CT
English	.175	.045	.154
Social Science	.225	.096	.190
Science	.145	.038	.134
Mathematics	.232	.028	.212
Psychology	.184	.027	.175
Grade Point Average	.222	.060	.209

Note. - R^2 is the squared multiple correlation coefficient.

DT variables are Anagram Fluency and Uncommon, Plot Titles Fluency and Quality, Uses Fluency and Flexibility, Consequences Fluency and Flexibility, and Word Meanings.

CT variables are SAT-Verbal and SAT-Math.

superior to these DT variables as predictors of academic achievement in college. It is evident that the DT variables account for little of the criterion variance that is not accounted for by the SATs. This finding is generalizable only to divergent thinking measures that are semantic in content. It is also generalizable only to institutions that select and evaluate students primarily on the basis of aptitude and achievement of the "convergent thinking" kind. Should the criteria for selection and evaluation emphasize "divergent thinking" or "creative" talents, it is expected that divergent thinking tests would have improved validity for predicting college success.

In the context of the present study, then, the hypotehsis, that divergent thinking tests are better predictors of academic course grades than are convergent thinking tests, is rejected.

In the Getzels and Jackson study (1962) the creativity tests were Word Association, Uses for Things, Hidden Shapes, Fables, and Make-up Problems. Of this group, Word Association, Hidden Shapes, and Make-up problems were equal or superior to Binet and Henmon-Nelson intelligence tests as predictors of verbal-content school achievement. The Make-up Problems test required numerical and mathematical skills in order for the subject to understand the examples and produce problems. The Hidden Shapes test is not at all semantic, consisting of geometric figures. Neither of these tests was related in content to any divergent thinking test of the present study. Word Association was similar to Word Meanings of the present study, as was Uses for Things similar to the present Uses test. Fables would appear to have much in common with Plot Titles.

The tests that correlated lowest with achievement in the Getzels and Jackson study were Uses for Things and Fables, which were much poorer predictors of achievement than were the intelligence tests. Their counterparts in the present study, Uses and Plot Titles, were also poor predictors of achievement.

Word Association predicted achievement as well as did the intelligence tests in the Getzels and Jackson investigation. Word Meanings in the present study also predicted achievement; not as well as did the SATs, but better than any other variable.

It appears that the outcomes of the Getzels and Jackson research and of the present investigation were basically similar where comparable variables were employed. The interpretations, however, differ. This is because Getzels and Jackson based their conclusion, that creativity tests are equal or superior to intelligence tests as predictors of achievement on the three creativity tests that were most related to intelligence tests. That two correlated variables also correlate equally with a third variable is not a surprising condition, as McNemar has pointed out (1965).

The fact that Uses for Things, and Fables, which correlated low with intelligence scores, were poor predictors of achievement was discounted by Getzels and Jackson. Those two tests have apparent counterparts in the present study that "belong" with the cluster of divergent thinking variables that, individually or combined as a team, do not compare faverably with the SATs as predicters of academic achievement.

It appears that "creativity" tests that are relatively independent of conventional ability measures tend to be poor predictors of academic achievement as it is usually evaluated. The same tests, however, may be valid predictors of judged creativity, as demonstrated in the present investigation.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Performances of college students on several tests of divergent thinking were compared with their scores on conventional measures of convergent thinking (SAT-V and SAT-M) to determine whether more than a single domain of psychological aptitude was represented by the two types of tests. The differential validity of the divergent and convergent measures was assessed by comparing their relative ability to predict performances on creativity and achievement variables. Sex differences in performance on the divergent thinking variables were tested for significance.

The divergent thinking tasks were Anagram (scored for fluency and uncommonness of responses), Plot Titles (scored for fluency and quality), Uses, and Consequences (both scored for fluency and flexibility), and Word Meanings, which had a single score. These tests were selected because they are all semantic in nature.

The creativity tasks consisted of writing imaginative essays to the stimuli of Card 1 of the Thematic Apperception Test, and to the bare plot of Hawthorne's story, "The Minister's Black Veil". The tasks were given two weeks apart, the time limit for each was ten minutes, and the subjects were encouraged to write imaginative stories. Four judges rated each essay for creative elaboration.

The achievement measures were academic grades in English Composition, Social Science, Science, Mathematics, Psychology, and over-all Grade Point Average for three semesters.

Five hypotheses were evaluated with the following results:

1. Sex differences in performance on the nine divergent thinking variables were not significant, except for female superiority in Anagram Fluency, and male superiority in Word Meanings. The hypothesis, which predicted no significant differences, was accepted with these restrictions.

2. Divergent thinking variables share more variance with each other than they share with convergent thinking tests. This was shown by objective cluster analysis, by Principal Component factor analysis, including a Varimax rotation, and by contributions to the multiple prediction of performance on several criterion variables. The second hypothesis was therefore accepted, with the following restrictions: (a) Anagram is excluded from the divergent thinking group because of its lack of correspondence with those variables, and its closer relatedness to the SAT variables, (b) Word Meanings, with its bridging role, is not considered to be exclusively associated with the divergent thinking group, (c) Plot Titles Quality, seemingly a good example of a divergent thinking variable, is recognized to be inconsistently related to the elements of that group. There remains a core of six divergent thinking variables (including Plot Titles Quality) that are more closely related to each other than to the SATs.

3. The hypothesis that divergent thinking variables are equivalent measures of a presumed unitary intellectual trait received some support from the results of investigating the preceding hypothesis. Further

analysis shows that the following restrictions apply: (a) The Anagram method of measuring divergent responding is excluded from the divergent thinking group because of its unrelatedness, (b) the fluency response mode is more consistent between methods of measuring divergent thinking than is the tendency to respond with varied and novel solutions, (c) Word Meanings, a measure that shares variance with every other variable in this study, is interchangeable with the core divergent thinking variables except where exclusiveness from convergent thinking variables (SATs) is implied.

4. Divergent thinking tests are better predictors of creativity, as measured by imaginative essay writing, than are convergent thinking tests (SATs). This hypothesis was accepted with the restriction that the divergent tests be combined as multiple predictors. Under that condition they were significantly better predictors, but, taken separately, the divergent thinking variables did not excel SAT-V. Combining SATs and the divergent thinking variables resulted in a significant improvement in prediction of creativity over the use of either set separately. These results have relevance for the second hypothesis, as well as the present one, for they indicate that there is considerable unshared variance between convergent and divergent variables, and within the divergent group as well.

5. Divergent thinking tests are not better predictors of academic achievement than are convergent thinking tests (SATs). In fact, the former contribute very little to the explained variance in college course grades, as shown by the low predictive power of the teamed divergent tests, and by the further evidence that they add little to the predictive

strength of the SATs when combined with them.

The results of this investigation suggest that divergent thinking variables that relate to judged creative behavior could advantageously be assembled into a battery that yields a single score. Components should be selected empirically, and not on the a priori basis of apparent-belongingness. Such a composite could be made practically orthogonal to the SAT type of ability measuring instrument, if that were desired.

While the "non-test" data-gathering procedure advocated by Wallach and Kogan (1965) is attractive as an analogue of the real-life situation in which creative productivity is assumed to occur, it appears that individual differences in performance on variables that predict creativity may be assessed by more economical psychometric methods. Despite explicit "test" directions and time limits, the subjects in this study were differentiated over a relatively wide range on all variables, and the "best" productions were very good, indeed. These findings bear out the point that Maddi (1965) makes: creative individuals often find themselves under stress to produce, and they often find their environment structured and evaluative.

If creative potential is conceptualized in behavioral terms, then individuals presumably differ in the ability to demonstrate relevant responses, when appropriate stimuli are supplied, and motivation is present. "Best" products no doubt require time and intention for adequate incubation and reworking, but it would be unexpected to find creative literary people, for example, unable to perform better than most on short notice.

This investigation has demonstrated the availability of simple divergent thinking tests that excel conventional ability measures as predictors of creative verbal performance. With increasing evidence of the feasibility of an objective psychometric approach to identifying potential creative talent, the need for economical scoring procedures is of primary importance. It is suggested that a solution to the problem of scoring divergent responses will be found in the utilization of computer techniques.

References

Barron, F. The disposition toward originality. J. abn. soc. *Psychol*., 1955, 51, 478-485.

Campbell, D., & Fiske, D. Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychol*. *Bull*., 1959, 56,81-105.

Christensen, P. R., Merrifield, P. R., & Guilford, J. P. *Consequences*: *manual* *for* *administration*, *scoring*, *and* *interpretation*. Sheridan Supply Company, Beverly Hills, Calif.

Cline, V. B., Richards, J. M., Jr., & Needham, W. E. Creativity tests and achievement in high school science. *J*. *appl*. *Psychol*., 1963, 47, 184-189.

Coffman, W. E. Convergent and divergent excellence. *Contemp*. *Psychol*., 1963, 8, 125-127.

De Mille, R., & Merrifield, P. R. Getzel's and Jackson's "Creativity and intelligence: explorations with gifted students". *Educ*. *psychol*. *Measmt*., 1962, 22, 803-808.

Drevdahl, J. E. Factors of importance for creativity. *J*. *Clin*. *Psychol*., 1956, 12, 21-26.

Flescher, I. Anxiety and achievement of intellectually gifted and creatively gifted children. *J*. *Psychol*., 1963, 56, 251-268.

Getzels, J. W. & Jackson, P. W. *Creativity* and *intelligence*. New York: Wiley, 1962.

Guilford, J. P. Fundamental statistics in psychology and education. New York: McGraw-Hill, 1965.

Guilford, J. P. Personality. New York: McGraw-Hill, 1959.

Harman, H. H. Modern Factor Analysis. Chicago: The University of Chicago Press, 1960.

Holland, J. L. Creative and academic performance among talented adolescents. J. educ. Psychol., 1961, 52, 136-147.

Locke, E. A. Some correlates of classroom and out-of-class achievement in gifted science students. J. educ. Psychol., 1963, 54, 238-248.

MacKinnon, D. W. The nature and nurture of creative talent. Amer. Psychologist, 1962, 17, 484-495.

Maddi, S. R. Motivational aspects of creativity. J. Pers., 1965, 33, 330-347.

McColly, W., & Remstad, R. Comparative effectiveness of composition skills learning activities in the secondary school. Cooperative Research Project 1528, University of Wisconsin, Madison, 1963.

McNemar, Q. Lost: our intelligence? Why? Amer. Psychologist, 1964, 19, 871-882.

Meadow, A., & Parnes, S. J. Evaluation of training in creative problem-solving. J. appl. Psychol., 1959, 43, 189-194.

Merrifield, P. R. Trends in measurement of special abilities. Rev. educ. Res., 1965, 35, 25-33.

Murray, H. A. et al. Explorations in personality. New York: Oxford Univers. Press, 1938.

Osborn, A. F. Applied Imagination. New York: Scribners, 1957.

Parnes, S. J. Effects of extended effort in creative problem solving, J. educ. Psychol., 1961, 52, 117-122.

Piers, E. V., Daniels, J. M., & Quackenbush, J. F. The identification of creativity in adolescents. _J. educ. Psychol._, 1960, 51,346-351.

Smith, R. M., & Neisworth, J. T. Creative thinking abilities of intellectually superior children in the regular grades. _Psychol. Rep._, 1966, 18; 335-341.

Taylor, C. W., & Holland, J. L. Development and application of tests of creativity. _Rev. educ. Res._, 1962, 32, 91-102.

Taylor, D. W. Variables related to creativity and productivity among men in two research laboratories. In C. W. Taylor & F. Barron (Eds.), _Scientific creativity_. New York; Wiley, 1961. 228-250.

Thorndike, E. L., & Lorge, I. _The teacher's word book of 30,000 words_. New York: Teachers Coll., Columbia Univer., Bureau of Publications, 1944.

Thorndike, R. L. Some methodological issues in the study of creativity. In _Proceedings of the 1962 invitational conference on testing problems_. Princeton: Educational Testing Service, 1963, pp.40-54.

Torrance, E. P. _Guiding creative talent_. Englewood Cliffs, N. J.; Prentice-Hall, 1962.

Wallach, M. A., & Kogan, N. _Modes of thinking in young children_. New York: Holt, Rinehart, and Winston, 1965.

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., and Karp, S. A. _Psychological Differentiation_ New York: Wiley, 1962.

Yamamoto, K. Research frontier: "Creativity": a blind man's report on the elephant. _J. counsel. Psychol._, 1965, 12, 428.

Yamamoto, K. Role of creative thinking and intelligence in high school achievement. _Psychol. Rec._, 1964, 14, 783-789.

APPENDIX A

ADMINISTRATION AND SCORING OF THE DIVERGENT THINKING AND CREATIVE WRITING TASKS

General procedures

The time required for test administration was approximately 80 minutes. Rather than take this block of time from the lecture schedule, which would require revision of the course outline handout, the tasks were given one or two at a time over several class periods. The procedure was to lecture until the last part of the period, when the tests were administered. The investigator was the course lecturer during the month of November, when the testing was done. The principal topics were Learning and Thinking, which lent a semblance of relatedness to the tasks.

Distributing the data-gathering in this manner has the effect of reducing correlation between variables. The relationships that were found tend to be conservative on this account. There was opportunity for the subjects to discuss the tests, and perhaps show a "Hawthorne effect" as testing proceeded, but this was not a matter of concern. The full cooperation of the subjects was clearly solicited, and the purpose of the study was not concealed. Every effort was made to get maximum performance on all of the tasks.

Student absences were at the rate of about 10 per cent per class. Distributing the testing did have the drawback of increasing the loss of subjects beyond the drop-out level. Of the 542 original students, 377 were present on all 5 tests days, and another 90 were absent but once. The latter were given a special testing on the last day of the semester. No more than 20 of this group had been absent on any given day, and they could have been assigned mean scores for the variables. The make-up was chosen in order to compare these performances with those of the rest of the subjects, to see if there would be an advantage for the make-up group. When this was done, it turned out that no significant differences were found.

At each testing occasion, while materials were being distributed, the examiner urged the students to relax, and stressed that the tasks were not examinations and would in no way influence their mark in the course. Timing of all tests was done with the clock on the podium which reads minutes and seconds. On all answer sheets the subjects wrote their name, seat number, and section. Before any scoring was done a serial code number was put on all papers and the identifying data were removed.

The succeeding material consists of detailed administration and scoring matters associated with each task. Scoring guides and sample protocols are also presented.

Anagram Administration

An answer sheet with 75 numbered answer spaces was distributed. The following instructions were read to the subjects:

"You have all perhaps, at one time or another, played the game called Anagrams. Given a word, the problem is to make as many words out of its letters as you can. The words must be at least two letters long, and must not be proper nouns. Words may be composed only of letters that are in the stimulus word, and a letter cannot be used in a word beyond its frequency in the stimulus word. For example, if there is one "e" in the test word, your words cannot contain more than one "e" each. A sample anagram with some solutions is shown on the center projection screen. Note that out of the test word "creatively", the words create, ate, rat, at, rate, car, care, tic, evict, eye, year, vile, and creative have been formed.

"Your score will depend upon the total number of words as well as the number of uncommonly found words that you write. Are there any questions? When your test word appears on the screen, copy it carefully on the line at the top of the answer sheet. You will have six minutes to make as many words out of it as you can. There is your word, generation, G-E-N-E-R-A-T-I-O-N. Copy it and begin."

Anagram scoring

Each answer sheet was first scanned by the scorer for duplicated or inadmissible words. Where there was duplication, only one of the words was scored. Inadmissible words included misspellings, homonyms of correct words, and words that required letters that were not in the stimulus word.

All acceptable words that appeared on the first answer sheet examined were printed on one-half inch wide strips cut from index cards. These strips were arranged alphabetically on the work table. As subsequent papers were scored by the two scorers, a tally mark was made on the strip to count for each recurrence of a word, and a new strip was prepared for words not previously found. The scorers worked side by side on this project.

When all papers had been examined, the tallies for each word were counted and a frequency distribution was prepared. This appears as Table 30 in Appendix B.

In order to give credit for different degrees of perceptiveness in finding uncommon words, three categories were chosen for differential point ratings. Words found by 10 per cent or more of the subjects were listed on a sheet and given the value of 1 point. Those produced by less than 10 per cent, but more than 2 per cent were listed with a 2 point weight, while words used by 2 per cent or less received 3 points. This was rather arbitrary point assignment, but did happen to distribute the 200 words into approximately equal-sized groups. Barron used the 3 per cent frequency as the criterion of "originality" with the same stimulus word (Barron, 1955). Wallach and Kogan (1965) prefer literal "uniqueness", one-of-a-kind frequency for their "uncommon" response category. However, the latter investigators purposely extended the period for responding to the point of satiation, thereby getting numerous unique responses to the several tasks. In the present case speed of responding was required. Had literal uniqueness been the criterion, only 17 words would have qualified for inclusion as uncommon.

All answer sheets were then scored, with the point-rating lists as the guideline. The total number of acceptable words was recorded as the fluency score for each subject. The sum of the 2 and 3 point words was also recorded, providing a score for uncommon usage for each subject.

In an attempt to determine whether the words rated as common or uncommon on the basis of frequency of usage in this situation were also relatively common or uncommon in general usage, the Thorndike and Lorge word list was consulted (Thorndike & Lorge, 1959). Each of the 200 anagram words was checked against the List of Words Occurring at Least Once per 1,000,000 Words, with the results shown in Table 31 in Appendix B. The frequency distribution of the 200 anagram words arranged by ratings for uncommonness and by Thorndike-Lorge frequency rating, appears in Table 26, on page 76.

The AA and -1 categories are inverse, and nearly perfectly related across the Uncommon point ratings. The detection of hidden words is, in part, a function of their frequency of appearance in print. So marked is the relationship here that a two-point scale could be developed by rating all words on the Thorndike-Lorge basis, then assigning 1 point to all AA words, and 2 points to all -1 words. In this way differences in terms of commonness versus uncommonness would be maximized, and the result would correspond better than 70 per cent with the frequency-count method used here. This would not effect a savings in time or effort in a study like this one, because all 200 words would still have to be determined, and that was the difficult task. However, where small samples might be used, the lack of large-group norms would not present an insurmountable problem if recourse were made to the Thorndike-Lorge material for ratings on the common-uncommon dimension. For some occasions, where there is no interest in rating all words produced for frequency, the latter method would be economical and feasible.

Plot Titles administration

The Plot Titles test was presented on mimeographed sheets which were distributed face down as a control measure. On signal the papers were turned over and the directions were read aloud by the examiner. He

TABLE 26

RELATIONSHIP OF ANAGRAM UNCOMMON RATINGS TO THORNDIKE-LORGE FREQUENCY RATINGS FOR 200 ANAGRAM WORDS

			Anagram Word Ratings			
			1 point	2 points	3 points	
Thorndike-Lorge Frequency Ratings	**AA**		35	9	2	46
	A		4	6	2	12
	1-49		27	36	33	96
	-1		2	12	32	46
		Σ	68	63	69	200

Note. - Thorndike-Lorge ratings are for frequency per million in diverse printed material. AA is the code for 100 or more per million, A is for 50-99. The 1-49 is the actual count per million words, and -1 is used for words that do not occur as often as 1 per million.

stressed the need to write titles for both plots in the allotted 6 minutes.

After 3 minutes of testing time had passed, the examiner announced, "Three minutes remain. Remember, you are to write titles for both plots; do not put too much time on one."

It was felt at the time that the presentation of both plots together was undesirable, but limitations on time were a paramount consideration. It would have been better, perhaps, to present each plot on the screen for 3 minutes in turn, requiring the responses to be written on separate sheets. A better control might be to interpolate other activity. There is no doubt that some subjects found it difficult to shift from one task to the other, tending to perseverate on their initial plot. This may have the effect of reducing correlation between the tasks.

The day before this test was administered an event occurred which lent unanticipated associations to the tale of the missionary. It happened that widespread news coverage had been given the report that some American missionaries in Africa had been slain and fed to crocodiles. There were a few comments about poor taste in presenting the Missionary Plot at that time, but, from the titles that were produced, most of the students seemed to accept the coincidence as an uncontrollable factor in research.

Plot Titles scoring

As an aid to objectivity in judging the titles for quality, all responses were typed, avoiding duplication, and the paper was then cut into strips containing one title each. For each plot the strips were numbered for easy reference. There were 987 Missionary, and 713 Fox titles.

Three judges, working independently with the complete set of titles for one plot at a time, separated the titles into groups of Clever and Non-clever titles. When one judge had finished rating in this manner, the serial numbers of Clever titles were recorded. All titles were then recombined and given to another judge.

Instructions to the judges were to rate the titles for originality, cleverness, humor, and imagination. It was agreed that some important features of high-quality titles include alliteration, rhyme, play on words, transformations, and image evocation. Of course, few titles could show more than a couple of these characteristics.

When all titles had been rated the records of the judges were consolidated, as shown in Table 27. Agreement by two of three judges was required for designation of a title as Clever. A list of 242 Missionary, and 90 Fox titles was thus compiled. Approximately 1 of every 4 Missionary titles, and 1 of every 8 Fox titles was judged Clever by this method.

TABLE 27

JUDGMENT OF PLOT TITLES FOR CLEVERNESS

	Missionary Plot	Fox Plot
Rejected as non-clever by all three judges	673	517
Judged clever by one judge only	72	106
Judged clever by two judges	158	54
Judged clever by all three judges	84	36
Total	987	713

Rater agreement was high for both sets of titles. For the Missionary plot, 84 titles were rated Clever by all three judges, and 673 titles were rejected unanimously. These agreements combine to 757, or 76.7 per cent of the total possible agreements. Two of the judges agreed in rating another 158 titles Clever, while only 72 titles received but one judge's approval.

In the case of the Fox plot, 36 titles were rated as Clever by all three judges, and 517 were rejected unanimously. These agreements combine to 553, or 77.5 per cent. Two judges agreed in rating another 54 titles Clever, while 106 titles received but one nomination.

The list of Clever titles was then submitted to five judges, two of whom had made the original ratings, and further evaluations of quality were made. The judges were asked to select from the list the best 50 titles for each plot and, further, to indicate which they thought were the very best titles of all. When ratings were combined, quality points were assigned to the titles. Being on the list meant that the titles had already passed one quality test, so all of these titles got one point. Those that received at least two nominations for quality in the final judging were assigned two points, the titles that received more than two such votes plus at least one "best" judgment, or four nominations without any "best" judgments, were given three points for quality.

When quality points were available the original protocols were scored. This was a simple clerical task. Two scores were recorded for each plot; the fluency score for number of responses, and the quality score, which was a summation of quality points for titles.

Scoring of a sample Plot Titles answer sheet

The responses of subject # 124 were scored as shown on page 81. There the numbers 3 and 4 on the left are the Fluency score for each plot. On the right, 1 indicates that the title was on the list of Clever titles. The +1 and +2 are the added quality values that further selection of titles for cleverness had determined. All but one of the responses of subject #124 were in the group rated clever; 2 received 1 bonus point each, and 3 were in the small set of titles rated Most Clever. These points were summed for each plot, and are the Quality score for this subject.

Uses administration

This test, which required that the subject give common and uncommon uses for five objects, was adapted from Getzels and Jackson (1962), who in turn had adapted it from the work of Guilford and associates (1959). Responses yielded two measures; fluency, for the total of acceptable responses, and flexibility, for the number of different categories or class-shifts represented by the responses.

Answer sheets divided into five numbered parts were distributed and the following instructions were read aloud by the examiner:

"You will be told the names of five objects. Two uses of each object will also be given. You are to write all of this on the answer sheet opposite the appropriate numbers. Your task is to write down as many uses as you can think of for each object. You will have ten minutes. Be sure to write down some uses for each object. Write anything that comes to mind, no matter how strange it may seem. Use your imagination!"

124

PLOT TITLES

Directions: On this sheet are two brief tales whose titles are missing. In the space below each you are to write as many different titles to head the stories as you can make up in three minutes. Use your imagination!

Plot 1. One hot summer's day a fox was strolling through an orchard when he came to a bunch of grapes just ripening on a vine which had been trained over a lofty branch. "Just the thing to quench my thirst", thought he. Drawing back he took a run and jump, and missed the branch. Again and again he tried after the tempting morsel, but at last had to give it up. As he walked away he was heard to mutter: "They were probably sour, anyway".

Titles:

"It's a Grape day" 1+1

3 "Bad Day at Grape Vine", 1+1

"Divine Comedy" 1+2

3+4=7

124

Plot 2. A missionary who has been captured by cannibals is in the pot and about to be boiled. At this moment a princess of the tribe obtains an assurance of his release if he will become her mate. The missionary refuses, and the boiling proceeds.

Titles:

4 "It's Better to Boil Than to Burn with Pasion" 1

"With God as My Chef, I Shall Not Marry A Heathen".

"I'd rather percalate than take a mate." 1+2

"Me, A Southern Baptist, Marry a Negro?" 1+2

3+4=7

The five objects, with a common and uncommon suggested use for each, were then dictated. When the last had been recorded the ten minute time-period began, with the verbal reminder, "You have just ten minutes to write as many different uses as you can for all of these objects. Be sure to give uses for each of them."

Uses scoring

Considerable planning went into the preparation for the scoring of these responses. The fluency score was no problem, for there were few responses that could not be allowed. The flexibility score, however, required that classes or categories of uses be predetermined. In order to get a wide range of responses for categorization, three scorers read a sample of unusable answer sheets (from subjects who missed tests or dropped the course), added their own responses, and came to an agreement as to what would constitute a response category. Practicing on many papers, the scorers were able to evaluate responses in a nearly identical manner. A test run of 50 independently scored/papers from the main sample yielded an inter-scorer coefficient of reliability of .99, therefore one scorer was given the task of scoring all of the papers.

The average intercorrelation between the five test items was .38. This provides an estimate of reliability for the whole test of .75, using the intraclass correlation method, which is based upon the analysis of variance (Guilford, 1965).

Uses categories for flexibility score

BRICKS:

Construction (buildings, steps, walls).
Surface (walks, roads, patios).
Missile (throw to injure, get attention).
Sculpting (forming or shaping a brick).

BRICKS: (continued)

- Weight (anchor, hold things down or in place).
- Marker (boundary, baseball base).
- Graphic (mark with, mark on, use to color).
- Hammer (bludgeon, pound things).
- Elevator (to stand on, to raise something).
- Prop (hold window open, replace leg of stove).
- Lever (use as a lever or as a fulcrum).
- Wedge (keep car from rolling, derail train).
- Fragment (crush for walk, formal garden).
- Decoration (in garden, on a surface).
- Communications (arrange to show direction, spell message).

PENCILS:

- Graphic (draw, color, doodle).
- Dowel (tourniquet, wind string).
- Weight (scale balance, plumb bob).
- Probe (clean ears, crevices).
- Toy (pick-up-sticks, spinner, logs).
- Marker (bookmark, boundary).
- Counter (arithmetic).
- Designs (pencil arrangements).
- Pointer
- Straight edge
- Roller
- Separator
- Spindle
- Stirrer
- Spear
- Scratcher
- Kindling
- Noisemaker

PAPER CLIPS:

- Hold things together (tie clip, button substitute).
- Probe (clean small places, open clogged passages).
- Hook (as supporter, to pull objects).
- Pin (hold things in place, make holes).
- Missile (with sling shot, propel with fingers).
- Lever (screw driver, turner).
- Chain (bracelet, pull chain substitute).
- Marker (bookmark, boundary).
- Electrical conductor
- Decoration (earring, design).
- Key ring
- Design (bend into shapes).
- Tension reducer (twist when nervous).
- Scratcher

TOOTHPICKS:

Fasteners (pin together, as in sandwiches).
Probe (clean nails, crevices, swab).
Pin (hold things in place, pierce).
Construction (mobiles, miniature buildings, 3D designs).
Toy (pick-up-sticks, matchstick figures).
Prop (keep paper off frosting, hold lobster claws open).
Spreader (to spread glue, paint).
Combustible (kindling, as a taper).
Spear (hors d'oeuvres, cherries).
Scratcher
Stirrer
Tension reducer (chew when nervous).

PIECE OF PAPER:

Graphic (draw, paint, make signs, book, newspaper).
Marker (bookmark, target, placemat).
Covering (liner, rug, raingear, conceal, wallpaper).
Combustible (start fire, taper).
Wiper (use to clean, dry, blot).
Separator (use to stuff, to fill out).
Container (bag, cup, wrapper).
Decoration (3D mobile, oragimi, papier mache figure).
Cut-out (shapes, patterns, dolls).
Tube (pipe, funnel, telescope, cigaret, megaphone).
Ersatz (hats, houses, tents, clothing).
Toy (propellor, boat).
Ball (spitball, basketball).
Tension reducer (crumple or tear aimlessly).
Fan or swatter
Shred (to make confetti).
Insulation.

Scoring of a sample Uses answer sheet

The responses of subject #441 (shown on page 85) were scored as follows:

Object	# of responses	# of categories
BRICKS	4	4
PENCILS	1	1
PAPERCLIPS	2	2
TOOTHPICKS	2	2
SHEET OF PAPER	4	4
Total	13	13

441

(USES)

1. bricks
1.) build houses
2) doorstop
3) to make a shelf with pieces of wood.
4.) paperweight
5.) to pile on top of one another to reach something
6) to put behind wheels of car on hill
7.) ~~to~~

2. pencils
1.) to write
2.) bookmark
3.) to chew on
4.)
5.)

3. paperclips
1.) paper (clip)
2.) necklace
3.) use when you don't have bobby pin
4.) clean nails

4. toothpicks
1.) pick teeth
2.) test a cake
3.) club sandwiches
4.) hors d'oeuvres
5.)

5. sheet of paper
1.) to write on
2.) paper airplane
3.) to use as insulator on clothing
4.) to tear in little pieces
5.) to burn
6.) make pictures

The sum of the responses is 13, which is the subject's Fluency score for Uses. All responses were in discrete categories, therefore the number of categories represented by the responses was also 13. This is the Uses Flexibility score for subject 441.

This paper is one that was scored independently by two scorers. The second scorer gave the same points as shown above for the first scorer, except that she allowed but 1 point for # of categories in the TOOTHPICK responses. The responses "club sandwiches" and "hors d'oeuvres" are in the same category, "party", but the use of a toothpick to hold pieces of bread together is different than its use as a spear. The first scorer was following the check sheet more closely.

Consequences administration

The mimeographed sheet bearing the single consequences problem and the simple directions for responding was distributed to the subjects. The examiner read the material aloud while the subjects read it silently. This was an original problem, although the type has been in use for some time (Christensen, Merrifield & Guilford). The problem and directions for answering were as shown on page 87.

Consequences scoring

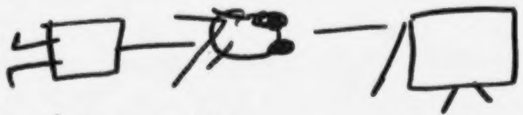
The scoring of this test caused more concern than any of the others. The fluency score was no problem, but attempts to rate responses for immediate or obvious versus remote consequences had to be abandoned because the judges could not reach agreement on differentiating criteria. It was finally decided to make the quality score another measure of flexibility, by counting the number of different categories of consequences that were represented in each subject's responses. After considerable

003

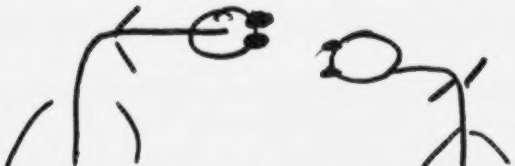
CONSEQUENCES

What do you suppose would happen if a sudden, universal mutation should take place and henceforth all babies were born with their eyes on the top of the head? Write down as many consequences of this change, both immediate and long-range, as you can imagine. You will have five minutes.

① The Hat makers would go into bankruptcy
② The Beatles haircuts would be out.
③ There would be no need to recruit Sky Watchers,
④ It would be hard to put in contact lenses.
⑤ Classrooms would have to be equipped with winches



⑥ people would talk to each other like this - a lot of bent backs



⑦ people would start dusting their ceilings
⑧ ~~They~~ you ~~can't~~ couldn't tell us from the moonmen.

discussion and practice scoring of unusable protocols, a set of categories was decided upon.

The scorer reliability, based on a sample of 100 papers that were rescored after a 4 week interval, was .75. This was, of course, for category-assignment consistency; the fluency measurement, based on the total number of responses, was errorless.

It is unfortunate that only one consequences problem was given, as this precluded a direct measurement of test reliability. On the basis of the communality value, however, the reliability of Consequences Flexibility, is estimated to be no lower than .80, and of Consequences Fluency to be no lower than .75, for the total sample. The derived communalities are given in Table 32 in Appendix C.

Consequences categories for flexibility score

1. Physical effects (mutations, discomfort, injury).
2. Economic effects (hat makers bankrupt).
3. Attitudinal changes (rejection of mutants, later acceptance, and rejection of current form).
4. Changes in physical world (devices for viewing, hat styles, ceiling art).
5. Interpersonal relationships (difficulties and adjustments in face-to-face situations).
6. Scientific or medical attempts to effect a cure.
7. Personal adjustments (hypersensitivity at first, hair and posture problems, locomotion difficulty).
8. Habit or interest changes (bird watching, astronomy).

Scoring of a sample Consequences answer sheet

The responses of subject #003 which appear on page 87, were scored as follows:

Response	Category
1	2
2	4
3	4
4	7
5	4
6	5
7	7
8	5

The Fluency score was 8, the category (Flexibility) score was 4.

Word Meanings administration

Mimeographed forms were distributed and the following directions, adapted from Getzels and Jackson (1962), were given by the examiner:

"You will be shown some words on the screen, one at a time. Each word has more than one meaning. You are to print the word when it appears, and write down as many different meanings for it as you can. The meanings need not be written out in full; often a single word will suffice. For example, for the word BARK you might write "tree, dog, seal, boat". These words refer to three different meanings of the word bark; the outer covering of a tree, the noise made by some animals, and a kind of boat. The meanings were not written out in full; only some words to convey these meanings were given".

"Your score will depend on the number of different words that you write (in this example it was four), and on the number of different meanings of the words (in this example it was three). If you had only time to write two words for bark, you would choose "tree" and "dog", say, rather than "dog" and "seal" because the former words exemplify two meanings while the latter are examples of the same meaning."

The stimulus words were exposed successively for an interval of one minute each. As each word appeared on the screen the examiner announced the word and directed the subjects to print it in its numbered place on the answer sheet. There was nothing to prevent the subjects from spending more than a minute on some words and less on others. They were, however, urged to work on the words as they became available. It was thought that the successive presentation of the stimuli resulted in better distribution of effort over all words than presenting the words on the mimeographed form would have done.

Word Meanings scoring

On scanning a few papers it was apparent to the team of scorers that some subjects interpreted the task as one of "free association". The directions had stressed the need to give alternate meanings of the stimulus words. The intention was to have the subjects emit different dictionary meanings in order to determine how versatile their operant vocabulary might be. The words were selected for having multiple meanings; arm, for example has 26 different usages according to Webster.

The subject who responded to the word port with "water, sea, ocean, land, harbor, ship, boat" gave but one meaning in the dictionary sense. His associations could be interpreted as meaningful in the semantic sense; indeed one could study meaning of concepts in this manner. However, the present approach was differently conceived, and the directions called for controlled associations. It would be gratuitous to assume that the subject meant "port-hole" or "left side" when he wrote "ship", given the context in which the word appears.

It was expected that within a category of meaning more than one example might be given. For example, the word rake may refer to the inclination of a ship's mast and also to the appearance of a car that has its rear end lowered. In both cases the meaning is "inclined from perpendicular", so 1 point would be scored for number of meaning categories, and two points for fluency.

When free associates were discounted, it was found that most of the responses were discrete in terms of meaning. The fluency score for a sample of 50 papers correlated with the number of different meanings (flexibility) at .99.

The decision was made, then, to have but one score for Word Meanings. This score would represent the total number of denotative meanings given for the 10 words.

Independent scoring of 50 papers by the two scorers yielded a reliability coefficient of .94. The average intercorrelation of scores for the 10 words was .20. The estimate of reliability of the 10 words combined as a single test was .72, as determined by the intraclass correlation method (Guilford, 1965).

Meaning categories for Word Meaning score

RAKE: tool; gather or draw; level or smooth; slant or incline (include car and ship here); roue; assemble or acquire; scan; bring to light; comb through or search; gunfire; claw or scratch.

BIT: small amount; short time; bridle; p.p. of bite; money; tooth on gear; drill; cutting edge on tool; part in play; piece of information; "fell for", horse.

Not allowed: rabies, teeth, muzzle, animals.

ARM: forelimb; protective devices and measures (v.); protective devices (n.); to ready a weapon; --- of a coat; slender extension; elbow rest; hold or lead a person; branch of service; baseball; length or distance; abstract usage (arm of the law, morally ready oneself).

Not allowed: soldier; part; apartment; gesture; a trade name; appease; parts of the body (legs, hand).

PORT: harbor; haven; place of commerce; outlet; gun opening; gate or door; bearing; wine; open garage; ship window; notion of carrying; side (n. & v.); abstract usage (girl in every, foreign places).

Not allowed: coast; place name; anchor; sea; sail; glass; wing; company name; busy place; ship; water.

CAP: hat; cover (n. & v.); top of mountain; to top or finish; bedtime drink; explosive device; firecracker; to put on (nurse); paper size; slang address; capital letter; top of a wave.

Not allowed: Civil Air Patrol; Red Cap; re-cap; C. A. P. (charge account).

PITCH: thrown; inclination or slant; to toss or rock; baseball; sap; "line"; card game; music, sound; black; level of activity; mineral; fall; "idea"; put up a tent; help.

Not allowed: pitcher; waiver; low, high; hit, catch; drink; hysteria; hurler.

PINK: color; cut (draw blood); cut cloth; Leftist; good condition, health; happiness ("tickled pink"); flower; baby girl (where it is in context of "pink for"); a kind of ship.

Not allowed: specific objects that are pink; little finger (Pinky); a sound (ping or plink?).

FILE: arrange or put away in order; tool or device with rough surface; line up in order; march in column; to manicure; to smooth objects; a cabinet; the record; rank and ---; make a report.

Not allowed: fabric (faille); chisel; drill; notebook.

BOLT: lock (n. & v.); to fasten together; fastener; eat hurriedly; dash, dart; lightning; gun; shock; metal cylinder of hinge; cloth; leave, abandon (--the party).

Not allowed: wad, hunk; food that lodges in throat.

FAIR: carnival; average; pleasant weather; light complexion; honest, just; attractive; curve of boat's hull; favored one("fair-haired"); "inconstant one ("fair-weather friend"); playable (fair ball).

Not allowed: fare; fun; marks; teachers; skin; hair.

Scoring of a sample Word Meanings answer sheet

The responses of subject #124, which appear on pages 94 and 95, were scored as follows:

Stimulus word	# of categories
RAKE	2
BIT	4
ARM	4
PORT	5
CAP	3
PITCH	5
PINK	4
FILE	5
BOLT	3
FAIR	6

The sum of the scores is 41, which is this subject's score for Word Meanings. Another scorer gave 39 points to this paper, indicating some difference of opinion concerning the number of categories represented.

An example of associations that do not involve a number of different categories of meaning is seen in the responses to RAKE. Here there are only two meanings of the word; the verb form (to rake things), and the noun (a tool). Similarly, "roses, fever, blushing" all have the connotation of the color pink, for which "red and white" was credited.

1. RAKE

leaves, COAL, yard, garden, steel, tool,

2. BIT

horse, dog, animal, small particle, unimportant part in a play,

3. ARM

Weapon, extremity of human body, chair or furniture, to camp,

4. PORT

wine, harbour, ships, trade, cove, shelter, whaling, departure or entry

5. CAP

hat, baseball, to top or cover, bottle,

6. PitcH

music (sounds), black, baseball, make a play at someone or something, throw,

7. PiNK

Red and white, roses, baby girls, fever, blushing, feeling well, slightly communistic,

8. FiLE

tool, rasp, to neatly store away, cabinet, march in a single row or file, finger nails,

9. BoLt

horses, screwdriver, nut, break away, construction, speed away quickly

10. FaiR

honest, Carnival, Clear (weather), baseball or other sports, feminine quality of beauty, blonde hair & light skin

Creative writing task administration

The description of administration procedures given in the body of the report is sufficiently detailed to preclude further consideration here.

Creative writing task scoring

Detailed instructions to the judges appear in the body of the report, and will not be repeated here.

The judges met to discuss the problems involved in rating the protocols for creativity. The instructions were gone over in detail, and several unusable papers were read and scored in concert. Implicit bases for rating the essays were, as far as possible, made explicit. Group discussion helped the judges to feel that they were approaching the task in a similar manner, that they were looking for the same qualities in the papers.

The extent to which they did, in fact, agree on the actual judgments is shown in Table 28.

TABLE 28

INTERCORRELATIONS OF ESSAY TOTAL SCORE RATINGS BETWEEN THE JUDGES

(Total sample; N = 417)

Judges	1	2	3
1. Male English Teacher			
2. Female English Teacher	54		
3. Male Psychology Teacher	58	58	
4. Female Elementary Teacher	48	51	52

Judge #3, the male Psychologist, made ratings that had the highest intercorrelations between the judges. There is no indication of any systematic difference in rating by the English instructors, compared with the other judges. Both English teachers had several years of experience in teaching Composition to college freshmen. Whatever factors operated to produce differences in judgments of creativity were unrelated to the occupations of the judges.

Scoring of Creative Writing samples

The pages that follow contain several protocols of TAT and Veil essays. Table 29 shows the ratings that each of the judges gave to each essay.

TABLE 29

RATINGS OF TEN SAMPLE ESSAYS BY THE FOUR JUDGES

		TAT				Veil			
Protocol	Judge	1	2	3	4	1	2	3	4
003		3	4	4	4	4	4	4	3
369		3	2	3	4	4	4	4	4
504*		2	4	4	4	4	3	3	4
116		3	4	3	4	2	3	4	4
235		3	4	3	2	4	4	4	3
167		4	4	4	4	1	4	1	2
543*		4	4	3	4	2	2	2	2
093*		3	4	4	3	1	2	2	1
233		2	4	3	2	4	4	3	4
251*		3	4	2	2	4	4	4	3
338*		3	4	2	2	3	4	4	4
	Sum	33	42	35	35	33	38	35	34

Note. - *indicates male subject

These subjects had the highest total essay scores (TAT + Veil) in the study. It was found that judge #2 was consistently more lenient than the others. The discrepancy in ratings of #504 TAT may be due in part to the content. Judge #1 was a ministerial student as well as an instructor of English Composition, and his roles may have conflicted in this instance. The discrepancy in #167 Veil reflects the greater leniency of Judge #2.

TAT Essays

Subject 003, female

The little boy's name is something hideous like Egbert, or Kamahoff. He hates his Aunt Agnes because instead of giving him a machine gun, or a official Dick Tracy moon-maid honting outfit or a copy of Candy for Chanuka, she gave him a Stradivarios violin. He wanted to get back at her so he practiced and practiced. He became so good at playing Mozart's Violin concertos, that his dear mommy took him to that nice Hartt School of music where all the instructors gasped with astonishment when they heard this budding young genius. He became so very famous that those terribly cultured people at the Metropolitan Opera House asked him to be a guest permourner with Bob Dylan as his accompianist. Naturally he accepted this delightful offer.

In this picture he is sitting in the industrial arts room at Exeter (where he was gladly accepted, even though he is only 7, because of his talent). He is trying to figure out how on earth he can get that bomb he just made into the damn fiddle and give it to Aunt Agnes with having to take off the strings.

Subject 369, female

Johnny had taken violin lessons for many years and enjoyed them a great deal. His family was however very poor and could not afford to buy him his own violin and so he used someone elses for his lessons. Soon it was annoying to him because whenever he felt like playing he couldn't. Finally Johnny became desperate and stole a violin from the store window that he passed every day. It was his at last.

Unfortunately he was soon accosted and we see him here being detained in the police station. Sargeant OReilly felt sorry for the boy - he would be sharply reprimanded and kept under surveillance for a year to two years. Then the sargeant formulated a plan and put it to work. He collected money from as many people as he could and bought the same violin for Johnny. Meanwhile the boy was at the station fretting about what his parents would say when they found out. Then Mr. Smith from the store came in and said that the boy hadn't stolen and had actually paid for it.

Subject 504, male

"Jesus Christ' ma, I tell you I've got to go go to the john." See this is the bid. Lenord was born in a small mining town near Pittzburg. All his life his mother has been pushing him in to doing creative things; Giving him tests, you know the kind where you see a picture and have to write something creative. Well any way, she (his mother) got on this culture bit and told Lenord he wasn't to move from the table till he could play "Roll over Baby" by the Rolling Stones

Well Lenord got sick; too much candy and he's got to make it to the toilet seat, but his ma says "No".

You see, actually Lenord hasn't any legs so his mother would have to help him; and he is already stinking up the place. End of the game.

Subject 116, female

Past, present, future

This is young Bach. His father has told hime he must become a great violinist...tonight. Young Bach has been sitting here in this same seat all day. It is now two in the morning. He is day - no nightdreaming about a planet where all little boys naturally can play well. It just so happen planet XQR has just decided to contact earth men by telepathy. They will choose young Bach. They will use his body as the home of these great brain waves. Soon they will enter other home-bodies. The mind of young Bach will gone on sleeping in his world of never never land. When morning comes he (Bach) will be creative but the turn boy will be on a parellel world. Some day the waves and worlds will circle around and perhaps connect or tangle.

Subject 235, female

The boy's father is a concert violinist. He has told his son that it is in his nature to be naturally able to play the violin, in order to get him to practice. The son cannot understand this. He is unable to play. He feels he has let down his father. He feels that he is mentally uncapable of playing and thus takes to daydreaming. In his dream he finds himself trapped within the walls of a monstrus violin; all of the strings are whispering: "Play. Play. Play or you will never escape".

Subject 167, female

Another sequence in the life of Walter Mitty - dashing, debonair, man about town, violin soloist at the Philarmonic Symphonies big opening night.

With all the craze over the "Bedbugs","Slipping Rocks", and "Insecticides" the Phillies are losing fans and money. "Yeah! Yeah! Yeah!" music is sweeping Beethoven into becoming another has been. The audience is rough out there tonight. booing, hissing, turning up their transistor radios, blasting out the latest hit craze.

It's all up to you Mitty. You've got to swing the pendulum tonight and bring the world back to Bach. Strong grip! No! no blindfold, thank you. Crush out my cigarette. This is it!

Subject 543, male

In 1898 a small boy wanted a violin. He lived in Cuba with his father and uncle.

Although his father was poor he decided to give his son the instrument.

With the aid of the uncle, the father constructed a bomb which would go off 20 minutes after the timing device was activated.

In the middle of the night the father & the uncle boarded a US warship in Havana Harbor & robbed the safe of the payroll. In the safe they activated the bomb and then left the ship, leaving the bomb on board.

The next morning they took the money to town and bought a Strativoriers for the boy.

When they returned home they showed the boy the violin. He, in turn, showed them a newspaper with the headline: U.S.S. MAINE BLOWN UP IN HAVANA HARBOR!

Subject 093, male

A few hours ago, this boy was supposed to have a violin lesson. While his teacher (a very beautiful young blonde) was on her way to his house to give the lesson. On her way, she met a young man whom she was attracted to immediately. She fell in love, married, and then arrived late to teach him his violin lesson. Upon learning this he became very upset because he was sweet on her - he began to cry. She left without giving the lesson, and now he is sitting their waiting for the strings to dry because he had cried all over them. What he doesn't know is that as the strings dry, they will contract and break his violin, his last memory of her.

Subject 233, female

This is the story of a young boy who comes from a long line of musically inclined people. Both his parents are concert solists and his older brother is currently the toast of the town because of his adeptness at the piano keyboard.

This young boy however has no interest and apparently no talent in the field of music. His parents have insisted however that he study the violin. Today was supposed to be his lesson day, but he so resented having to go, and so feared he would not be as good as his brother, instead of going he pulled the strings off the violin and went home. He is now home waiting for his mother to arrive. He plans to tell her the violin has broken by accident, but he's afraid she won't believe him. Worse than not believing him she'll only have the violin fixed and he'll have lessons next week. He'd like to tell her that he doesn't want lessons but he doesn't feel she'll understand. He's right --- She won't!!

Subject 251, male

Music had been Mike's great love since he reasoned enough to select preferences from his generalized baby. Mike's family play good music in his room when he was a baby and he's been listening ever since.

But Mike is a bright boy and he wants more than just passive participation: he wants to recreate the beautiful sounds he's grown to love and admire.

Today, as Mike's lesson day on the violin, is very special to him. He is learning fast and loves the powers he feels developing in him...

On the way home Mike meets his friends who laugh and Mike now must make his decision. He doesn't know what to do so he just sits at home staring and thinking...

Subject 338, male

There it was, a beautiful summer day. It was the first time all week that it didn't rain and luckily enough it was the day of the championship game. Bill woke that morning and ran to the widow to see what the weather was like. He immediately broke into a big smile.

He then ran downstairs and ate breakfast. He didn't eat much though because he was just to excited. He grabbed his glove and made a beeline to the front door, but only five steps from the door he hear a cry from his mother. Bill, she said, "where are you going?". "Don't you remember you have to practice your violin this morning. A look of shock came over his face. He pleaded but his mother stood firm; and Bill walked to his room.

Veil Essays

Subject 003, female

Unknown to anyone in the congregation the minister has a dubious past. Before he became a mister he was a card shark and a gun fighter from New Orleans. He met a woman in the saloon and he fell in love with her. He married her and she begged him to put his guns away, however, he stubbornly refused. As a result he accidentally killed her in a gunfight. They had a child who was sent away to school and never saw his father again.

One day many many years later this extremely religious man was visited by an angle of God who told him that his son was searching for his father to revenge his mother's death. The minister, if he made a scrifice to God, would be spared the agony of meeting with his enraged son. The minister decided to wear a black veil over his face and suffer from the curiosity of the people in his church. He was never to take it off and never to tell anyone why he had to wear it. His son searched and searched and was led off the track but could never understand why he couldn't find his father - to tell him he forgave him.

God's punishment was letting the man believe that his son hated him - and never let him see him.

Subject 369, female

Everyone watched Reverend Josephs carefully during those weeks. They were suspicious and wary of this man of the cloth who chose to appear in their midst wearing a black veil. Speculation was running wild throughout the town. Soon people began to avoid him. "What has happened?", everyone asked. Tension mounted to the point of hysteria and every sunday became a time of fear. The Reverend became savage in his speeches and cursed and belittled his people.

Then a Sunday came when the Reverend did not appear in church. The small congregation waited for his violent entrance to be repeated as it had many times before. But their vigil was to no avail. They left quietly, a few of them mumbling about this strange action, when suddenly from behind them, in the church, there was a scream of agony, a thud and silence once more.

They never knew why he had hung himself, still with the black veil covering his face. No one even dared remove it. They buried him with it still over his face and wrote on his grave stone - "HERE LIES REVEREND JOSEPHS - A Man of two cloths"

Subject 504, male

"Days and nights are different eyes caught at midnight in a dream, all my thoughts are all pursued through a window for a sign."

The town I came from wasn't a rich town and it wasn't a poor town; it was a dying town. I had never known my father; mother said he died during the war.

It was cold; very cold this time of year, especially for Mississippi. One morning I awoke from the threshold of my dreams; stole quietly into the night and removed from the dark hidden archieves of a chest; a thousand lost memories.

Mother was long dead; I had never visited "Her" room till now. I found a dust covered letter... "John, your father was a slave."

Subject 116, female

The minister is a priest. In his second year of going to a seminary school, he fell in love with a"protestant agnostic" girl. Their love was a hopeless love and tempted the fates; but never the less, it lasted for many years. She stayed unmarried for many years and faithfully corresponded with him. At last she could wait no longer and she got married at the age of 60. The minister-priest's love never ended, but he wore a black veil from that time one. She was dead to him and to God - (She married a Jewish Rabbi).

Subject 235, female

The minister feels himself to be one of God's "elect". He enters into a parish in which the sins of the people are such a heavy burden the parish is one of total corruptness.

The minister's ideal of self-perfection cannot place this vulgarity into his complete whole, this with the use of a black veil, he shield his self-perfection, his purity, from the black corruption of the world outside. His pulpit is also screened from the rest of the small church. No one is ever allowed to come near him.

Pride in his self-perfection drives him from the parish in search of a town, of a society worthy, pure, enough to admit his presence. Arriving at a set of large golden gates, he is greeted by a man named Peter. He must in order to enter, remove his veil. Peter lifts the veil, and the rest of the clothing falls to the ground. There was emptiness. Nothing existed, for on earth, nothing is perfect!

Subject 167, female

The minister wore this black veil in an effort to get across to his congregation the idea that his expressing of the religion was not to be associated with the man. His ideas were not his own but that of the Bible and thus he should not be associated with them. The black veil did, however, isolate him from the rest of the community and set him apart from the average man so he defeated his own purpose.

Moral, us Micrin oral antiseptic and stop watching those crazy commercials on television.

Subject 543, male

The minister of a small town is expected to present an example to his congregation. This minister was presenting to his congregation the veil, which symbolized hipocrisy. He felt that although the people of the town said and did one thing, they really thought another. Thus, they were hiding behind the veil of hipocrisy.

Take for example one Mr. Annelida. He was a worm of a man. Although he treated the children of the town as something to find fault with, he really felt that he was being discriminated against by God because he and his wife couldn't produce children.

It is this type of character that the minister was trying to point out to the congregation.

Subject 093, male

The reason the minister wore the vail over his head is because his wishes to symbolize the spirit of his concregation.

The people of his church are people who attend out of habit and not of desire to worship. They file in, sing, sit, and half-pray, and leave as soon as the service is finished.

They donate little money even though they are rich.

The activities the church tries to perform, such as food sales, picnics, etc, usually fail because no one is interested.

Therefore the minister, wishing to shame the people of his concregation, wore the black vail to symbolize his congregation's spirit.

Subject 233, female

Minister: Black Veil.

That morning the minister appeared veiled in black. Why? the congregation asked. For what ungodly reason would the minister appear in this fashion?

One morning the congregation finally found the reason. It was Sunday, and the minister was in the pulpit vield as he had been for several months. A young girls barged into church and headed straight for the altar screaming violent curses at the minister. The parishoners were aghast. This young woman was no ordinary maiden. She was the town tramp, and she was obviously pregnant. Never before had she dared to enter church - but now! Why.

The girl's curses became more intelligable. They were aimed directly at the minister. The congregation was stupefied. This prostitute was accusing the minister of being father to her unborn child!

She ran towards the minister, clawing at him like a wild animal. She ripped at his veil covering. Once it was snatched of the ugly blister-like sores surrounding the minister's mouth could be seen by everyone.

The minister turned helplessly to the girl, - tears filled his eyes, shame was written on his face. But all the young tramp did was laugh hysterically -- "You've got syphilis!! You've got syph...

Subject 338, male

Why? What was the reason for the black veil. To find out we must go back twenty-three years when the minister was twentyfive. It was then that he was placed on this planet by his people from the planet Zyroqfx. His real name is Zeoro Winnypister. He was placed here to plant the seeds of a great migration to his planet by the people of Earth. When he came he was given human characteristics, but now after twenty-three years the Earth's atmosphere had started to cause irregularities in his system and his face had started to turn bright blue. He also received word that his planet had been destroyed and his people were enslaved by the people of the planet Oyria, so he had no where to go but spend the rest of his existence, which was slowly diminishing on Earth.

Subject 251, male

Charles Darwin's attacks on accepted knowledge were not attempts at disfiguring religion; but with progress, old institutions suffer and so it was with religion.

Harold Doubleday, a minister of 20 years service, loves to read. His reading proved a test for his faith and strength of spirit. Darwin was to become a central figure in that long term tempting of the devil of new ideas.

Subject 251, male (Continued)

Harold read Darwin with a closed heart but with a searching mind, and he believed. He felt that God was loosing his place on the earth of rational logical men. God! Harold thought, "I've been wasting 20 years of my life"...

Security is important to an old man and Harold couldn't renounce his religion; but he was basically honest and felt the need of demonstrating his long standing hypocrusy without endangering his position in the community.

Alergories had always intrigued him and he struck upon using a veil as a symbol of his hypocrisy. And Harold gained some comfort in the knowledge that his congregation would always wonder at his actions.

APPENDIX B

Frequency of Anagram Responses to Stimulus Word Generation (Table 30)

Thorndike-Lorge Ratings of the 200 Anagram Words for Frequency (Table 31)

Missionary Plot Titles

Fox Plot Titles

TABLE 30

FREQUENCY OF ANAGRAM RESPONSES TO STIMULUS WORD GENERATION
(N = 542)

rat	477	an	96	oat	24	goner	6
ration	414	rent	95	tog	24	ting	6
ton	391	are	91	irate	23	ago	5
near	381	grate	91	iron	22	argon	5
rate	360	gain	90	region	22	orange	5
nation	352	tire	87	groin	21	erate	5
tin	348	teen	85	into	21	nitrogen	5
tear	342	nine	84	tang	21	roe	5
gone	330	tore	84	tine	21	anger	4
on	330	age	83	ore	19	eager	4
ten	299	nor	81	negation	18	enrage	4
ate	289	neon	78	roan	18	iota	4
not	284	ant	70	ire	17	ogre	4
at	279	gent	70	nit	17	re	4
get	265	green	69	rating	17	regent	4
tan	261	torn	65	tanner	16	agree	3
eat	252	rig	62	tare	16	anion	3
net	248	goat	55	genera	15	ergo	3
ran	247	grain	51	engine	14	garnet	3
tar	246	art	47	nearing	14	girt	3
neat	233	or	45	toga	14	organ	3
gone	232	tier	44	tong	14	orient	3
no	229	toe	43	anon	13	toner	3
gate	212	tenor	40	ere	13	aeon	2
tag	202	air	39	gat	12	aero	2
era	201	rant	36	nog	12	agent	2
gear	184	greet	35	rein	12	anoint	2
it	182	ring	35	giant	11	anti	2
in	180	enter	34	inner	11	gar	2
none	177	earn	32	range	11	genie	2
gin	171	rota	32	tinge	11	ignore	2
got	170	tree	32	eating	10	tango	2
ion	169	gore	31	ego	10	trig	2
ear	168	grin	30	gee	10	ante	1
tea	162	tee	30	nee	10	earning	1
note	160	negate	29	reign	10	erg	1
rag	160	non	29	tearing	10	eta	1
tone	153	rite	29	tern	10	genet	1
great	145	groan	27	ti	10	giro	1
rain	144	riot	27	genre	9	granite	1
to	137	tiger	27	oar	9	inane	1
go	123	eon	26	ornate	9	ingrate	1
nag	121	grant	26	inn	8	integer	1
one	111	negro	26	innate	8	inter	1
gnat	108	rang	26	noting	8	intern	1
ratio	108	eaten	25	trio	8	ort	1
train	108	inert	25	neater	7	ranting	1
tie	106	gait	24	retain	7	renting	1
rot	104	grit	24	atone	6	ret	1
rage	101	nite	24	eater	6	toning	1

TABLE 31

THORNDIKE-LORGE RATINGS OF THE 200 ANAGRAM WORDS FOR FREQUENCY

1 Point			
AGE	AA	RAG	28
AN	AA	RAGE	49
ANT	38	RATE	AA
ARE	AA	RAN	AA
AT	AA	RAT	37
ATE	A	RATE	AA
		RATIO	11
EAR	AA	RATION	8
EAT	AA	RENT	23
ERA	14	RIG	6
		ROT	8
GAIN	AA		
GATE	AA	TAG	7
GEAR	9	TAN	14
GENE	0	TAR	10
GENT	1	TEA	A
GET	AA	TEAR	AA
GIN	9	TEEN	2
GNAT	4	TEN	AA
GO	AA	TIE	AA
GOAT	A	TIN	36
GONE	AA	TIRE	AA
GOT	AA	TO	AA
GRATE	13	TON	49
GREAT	AA	TONE	A
GREEN	AA	TORE	24
		TORN	34
ION	1	TRAIN	AA
IN	AA		
IT	AA		
NAG	5		
NATION	AA		
NEAR	AA		
NEAT	29		
NEON	0		
NET	A		
NINE	AA		
NO	AA		
NONE	AA		
NOR	AA		
NOT	AA		
NOTE	AA		
ON	AA		
ONE	AA		

2 Points			
		RANG	25
AYR	AA	RANGE	A
ANON	22	RANT	1
ART	AA	RATING	1
		REGION	A
EARN	A	REIN	25
EATEN	13	RING	AA
ENGINE	A	RIOT	14
ENTER	AA	RITE	10
EON	0	ROAN	2
ERE	35	ROTE	1
GAIT	9	TANG	1
GAT	0	TANNER	7
GENERA	0	TARE	1
GIANT	A	TEE	1
GORE	7	TENOR	6
GRAIN	A	TIER	3
GREET	A	TIGER	30
GRANT	AA	TINE	0
GRIN	21	TINGE	8
GRIT	5	TOE	35
GROAN	34	TOG	0
GROIN	0	TOGA	1
		TONG	6
INERT	5	TREE	AA
INTO	AA		
IRATE	0		
IRE	1	INNER	
IRON	AA		
NEARING	0		
NEGATE	0		
NEGATION	1		
NEGRO	47		
NIT	0		
NITE	0		
NOG	0		
NON	7		
OAT	23		
OR	AA		
ORE	18		

3 Points			
AEON	0	NEATER	0
AERO	0	NEE	0
AGENT	40	NITROGEN	12
AGO	AA	NOTING	0
AGREE	AA		
ANGER	A	OAR	11
ANION	0	OGRE	2
ANOINT	5	ORANGE	A
ANTE	0	ORATE	0
ANTI	3	ORGAN	48
ARGON	0	ORIENT	12
ATONE	2	ORNATE	2
		ORT	0
EAGER	39		
EARNING	6	RANTING	0
EATER	3	RE	0
EATING	0	REGENT	6
EGO	0	REIGN	44
ENRAGE	6	RENTING	0
ERG	0	RET	0
ERGO	0	RETAIN	36
ETA	0	ROE	4
GAR	0	TANGO	0
GARNET	2	TEARING	0
GEE	6	TERN	0
GENET	0	TI	0
GENIE	1	TING	1
GENRE	1	TONER	0
GIRO	0	TONING	0
GIRT	4	TRIG	0
GONER	0	TRIO	2
GRANITE	15		
IGNORE	17		
INANE	1		
INGRATE	0		
INN	27		
INNATE	2		
INTEGER	1		
INTER	4		
INTERN	1		
IOTA	0		

Note. - AA words appeared 100 or more times per million, A words 50-99. Numbers are frequencies per million, and zero (0) here means that the word appeared less than once in a million.

1-point words were found by 10 per cent or more of the present subjects, 2-points, by 2 through 9 per cent, and 3-point words were found by less than 2 per cent.

MISSIONARY PLOT TITLES

1. A BOILING LOVE AFFAIR
2. A BURNING SITUATION
3. ACCEPT A "DISH" OR BECOME ONE
4. A FINE KETTLE OF SOUP
5. A GOOD DINNER
6. A "GOOD" MEAL
7. A HELL OF A SITUATION
8. A HOT PLOT
9. A HOT SPOT
10. A HOT SITUATION
11. A HOT TIME IN THE JUNGLE
12. A HUSBAND FOR DINNER
13. A HOT PREDICAMENT
14. A HOT TIME IN THE TOWN TONIGHT
15. ALTERNATING WAYS TO GET YOUR MAN
16. A MAN IN HOT WATER
17. AMEN
18. A MISSIONARY FOR DINNER
19. A MISSIONARY: HIS POT AND HIS PRINCESS
20. A MISSIONARY IN HOT WATER
21. A MISSIONARY'S STEW
22. ANY VEGETABLES?
23. A POTTED PLOT
24. A PRINCESS IN TIME SAVES NEIN
25. A QUESTION OF JUMPING OUT OF THE PAN INTO THE FIRE?
26. A RELIGIOUS FEAST
27. A SHORT LOVE STORY IN ONE ACT
28. A VERY HOT DAY
29. A WARM GOOD BYE
30. A WARM PROPOSAL
31. A WARM SITUATION
32. A WHITE COLLAR DINNER

33. BEAUTY AND THE PRIEST
34. BETTER BOIL THAN TOIL
35. BETTER BOILED THAN SPOILED
36. BETTER COOKED THAN HOOKED
37. BETTER DEAD THAN WED
38. BETTER FATE THAN MATE
39. BETTER LUCK NEXT TIME
40. BETTER TO BE BOILED THAN TO BE SCORCHED
41. BETWEEN HELL AND HOT WATER
42. BETWEEN THE DEVIL AND THE DEEP BLUE SEA
43. BOIL OR SOIL
44. BOILED AGAIN
45. BOILED BUT UNSPOILED
46. BOILING HOT
47. BOILING OVER WITH PRIDE
48. BOILING PROCEEDS GO TO CANNIBALS

49. BUBBLE, BUBBLE, SIN AND TROUBLE
50. BUBBLE BUBBLE TOIL AND TROUBLE, OR MARRIAGE
51. CANNIBAL CAPERS
52. CANNIBAL STEW
53. CANNIBALS DELIGHT
54. CHANGES ARE NEEDED IN THE MODERN CHURCH
55. CHOICE OF POTS
56. COOK OR BE HOOKED
57. COOKING MORE BUT ENJOYING IT LESS
58. COOL IT BUDDY

59. DECISIONS....DECISIONS
60. DEDICATED DEACON
61. DIE-HEARTED
62. DINNER FOR ONE
63. DISCRIMINATION IN MISSIONARIES?
64. DOES HE OR DOESN'T HE?
65. DON'T BE FUSSY, BROTHER
66. DON'T PLAY WITH YOUR FOOD BEFORE YOU EAT IT
67. DOUBLE DOUBLE TOIL AND TROUBLE, FIRE BURNS CALDRON BUBBLE
68. DOUSE THE FIRE I WANT OUT

69. EITHER HOOKED OR COOKED
70. EVERY OLD MISSIONARY HAS A POT

71. FEAST FOR A SUNDAY AFTERNOON
72. FIRED TO HEAVEN
73. FOOD FOR THOUGHT
74. FOOLED CANNIBALS--HE WAS A FRIAR
75. FRENCH FRIED FLESH
76. FROM THE FRYING PAN INTO THE FIRE

77. GOOD SUPPER TONIGHT
78. GONE TO POT

79. HARD BOILED
80. HEART OR SOUL
81. HE REFUSED TO GO FROM THE FRYING PAN INTO THE FIRE
82. HE WHO REFUSES--LOSES
83. HE'D RATHER BE MEAT THAN MATE
84. HEATED DECISION
85. HER MATE IS IN A STEW
86. HIS LAST RESORT: A STEW
87. HOT IN THE POT
88. HOT IS MY LOVE
89. HOT POT OR A ROOMMATE
90. HOT UNDER THE COLLAR
91. HOW TO GET YOUR MAN
92. HOW TO MAKE A GOOD MEAL AND STILL STAY SINGLE

93. HOW TO MAKE MISSION STEW
94. HOW TO REFUSE A GIRL EVEN WHEN YOU'RE HOT
95. HOW TO SERVE YOUR FELLOW MAN
96. HOW YOU GONNA KEEP 'EM OUT OF THE POT AFTER THEY'VE SEEN MARIE (PRINCESS)?
97. I REGRET THAT I HAVE BUT ONE LIFE
98. I TOOK THE EASY WAY OUT AND IT BURNED ME UP
99. I WAS GOING STEADY, WHAT ELSE COULD I DO?
100. I WISH IT WAS FRIDAY BY A SAD MISSIONARY
101. I'D NEVER BE ABLE TO WALK THE STREETS AGAIN ONE WAY OR THE OTHER
102. I'D RATHER BE EATEN THAN BEATEN
103. I'D RATHER BOIL THAN SWITCH
104. I'D RATHER DIE THAN SWITCH
105. I'D RATHER PERCOLATE THAN TAKE A MATE
106. IT IS A FAR FAR BETTER THING THAT I DO
107. I'LL SAVE YOU MY LOVE OR DON'T WORRY JOHN I'LL GET YOU OUT OF THIS STEW
108. I'M ALWAYS IN HOT WATER
109. I'M IN A STEW!
110. IN A STEW
111. IN HOT WATER
112. IN HOT WATER AGAIN
113. IN PLENTY OF HOT WATER
114. IT ISN'T ALL THAT BAD
115. IT ONLY HURTS FOR A LITTLE WHILE
116. IT'S A FEAST EITHER WAY
117. IT'S BETTER TO BOIL THAN TO BURN
118. IT'S BETTER TO BOIL THAN TO BURN WITH PASSION
119. IT'S HOT WATER EITHER WAY

120. LAST RESORT
121. LAST SUPPER
122. LOVE DOESN'T ALWAYS CONQUER
123. LOVE DOESN'T CONQUER ALL
124. LOVE IS NOT SO HOT
125. LOVE ME OR LEAVE ME

126. MARRIAGE ON THE POT
127. MATE OR GET ATE
128. ME A SOUTHERN BAPTIST, MARRY A NEGRO??
129. MEAT OR MATE
130. MISSION ACCOMPLISHED
131. MISSIONARIES ARE GOING TO POT
132. MISSIONARY COOKS OWN GOOSE
133. MISSIONARY IN A HOT SPOT
134. MISSIONARY IN A HOT TIN POT
135. MISSIONARY IN HOT WATER
136. MISSIONARY STEW
137. MISSIONARY STEWED

138. MIXED MARRIAGES ARE NOT A GOOD IDEA
139. MORTIFICATION
140. MY GOOSE WAS COOKED

141. NEW FOREIGN DISHES
142. NO CONVERTS
143. NO MALE FOR THE PRINCESS
144. NO SENSE JUMPING OUT OF THE POT AND INTO THE FIRE
145. NOT ALL PRINCESSES ARE BEAUTIFUL
146. NOT ME SISTER

147. OUT OF THE FRYING PAN INTO THE FIRE
148. OUT OF THE POT AND INTO THE FIRE
149. ONCE A POT A TIME
150. ONE PRIEST TO GO
151. OUT OF THE FIRE INTO THE POT
152. OUT OF THE POT AND INTO THE FRYING PAN

153. PASS THE SALT
154. PASSION POT
155. POT LUCK
156. POT LUCK DINNER
157. POT LUCK MAN OF GOD
158. POTTED ROMANCE
159. POT-TICULAR MOMENT
160. PRIDE AND PREJUDICE
161. PRINCESS GETS MEAT INSTEAD OF MATE
162. PRINCESS PLEASE I'D RATHER DO IT MYSELF
163. PUTTING THE PRESSURE ON

164. RARE, MEDIUM OR MISSIONARY
165. RATHER KEEP HIS HAND TO HIMSELF
166. RECIPE FOR MISSIONARY MUNCH

167. SEX POT
168. SHE ATE HER MATE
169. SHE MUST HAVE BEEN A BEAUTIFUL PRINCESS
170. SHOT DOWN AGAIN
171. SMOKE GETS IN MY EYES
172. SMOKE GETS IN YOUR EYES
173. SOME LIKE IT HOT
174. SOME PEOPLE WOULD RATHER STEW
175. SOMETHING HER BEST FRIEND WON'T TELL HER
176. SOUP OR STOOP
177. SOUP'S ON
178. STALE MATE
179. STEW
180. STEWED TO THE GILLS
181. STORY OF A SOUTHERN MISSIONARY IN AFRICA

182. STRUGGLE UP A LITTLE CLOSER

183. TASTY THEOLOGIAN
184. THANK GOD FOR ASBESTOS SKIN
185. THE BETTER OF TWO EVILS
186. THE BOILED FRIAR
187. THE BOILING LOVE
188. THE CASE OF THE BOILING MISSIONARY
189. THE CASE OF THE COOKED MISSIONARY OR BOILED AGAIN
190. THE CHOICE OF A LIFETIME
191. THE EASY WAY OUT
192. THE FIRE DOWN BELOW
193. THE FLAME OR THE FIRE
194. THE HARD BOILED MISSIONARY
195. THE HEAT BEFORE HEAVEN
196. THE HOT MISSIONARY
197. THE LESSER OF TWO EVILS
198. THE MAKING OF A MISSIONARY
199. THE MAN WHO CAME FOR DINNER
200. THE MAN WHO CAME TO DINNER
201. THE MARRIAGE FEAST
202. THE MISSIONARY CAME TO DINNER
203. THE MISSIONARY POT BOILS
204. THE MISSIONARY WHO STAYED FOR A CANNIBAL SUPPER
205. THE MISSIONARY WHO WAS INVITED FOR DINNER
206. THE POT BOILS
207. THE POT THAT BOILED
208. THE POTTED MISSIONARY
209. THE PRINCESS' STEW
210. THE RED HOT PRINCESS
211. THE RED MISSIONARY
212. THE SAGA OF THE SOGGY MISSIONARY
213. THE STORY OF A DIEHARD
214. THE STEWED MISSIONARY
215. THE WATER ISN'T THAT HOT YET
216. THE WAY I WENT TO DINNER
217. THERE IS NO FURY AS THAT OF A WOMAN SCORNED
218. THEY'LL GET YOU IN THE END
219. TO BE EATEN OR BEATEN
220. TO BE HOOKED OR COOKED THAT IS THE QUESTION
221. TO BED OR TO BROTH
222. TO BOIL OR NOT TO BOIL?
223. TO SUFFER LIFE--OR DEATH
224. TOO HOT TO HANDLE
225. TROUBLE BREWING
226. TRUE LOVE NEVER RUNS SMOOTH
227. TWO TYPES OF HOT WATER

228. UGLIER THAN DEATH
229. UNACCUSTOMED TO LIVING WITH ROYALTY

230. WELL DONE
231. WHAT A HOT WAY TO GO
232. WHAT A STEW
233. WHAT A WAY TO GO
234. WHAT TO DO IN A STEW
235. WHAT'S IN THE POT ISN'T ALWAYS HOT
236. WHERE'S THAT ECLIPSE
237. WHICH POT DO YOU PICK
238. WHO'S FOR DINNER
239. WHO'S GOOSE IS COOKED?
240. WHO WANTS A HUNGRY MOTHER IN LAW

241. YOU ASKED FOR IT
242. YOU CAN'T TAKE IT WITH YOU

FOX PLOT TITLES

1. A BAD DAY AT THE GRAPE VINES
2. A BAD DAY AT THE ORCHARD
3. A FOX IN A FIX
4. A FOXY REPLY
5. A FUNNY THING HAPPENED TO ME ON THE WAY TO THE GRAPEVINE
6. A GRAPE THAT IS THINE IS WORTH TWO ON THE VINE
7. A GREAP PREDICAMENT
8. ALL DRIED UP
9. AMBITION FERMENTS
10. A SOUR EXCUSE
11. A SOUR HOUR
12. A SOUR LOSER
13. A SOUR SAGA
14. A SOURED THIRST
15. A THIRSTY SITUATION MEETS A SOUR ENDING
16. A TRYING SITUATION
17. A WINEY TALE

18. BAD DAY AT GRAPE VINE
19. BEYOND REACH
20. BITTER BACCHUS
21. BROAD JUMPER??

22. DIVINE COMEDY

23. FOXES WOULD RATHER SWITCH THAN FIGHT
24. FOX TROT
25. FOX TROT AND MISS
26. FOX WHO DOES NOT GET GRAPES GETS SOUR
27. FOX'S FOLLY
28. FRUSTRATION IS A BUNCH OF GRAPES

29. GRABBING GRAPES
30. GRAPE GRAPPLING
31. GRAPES ARE FOOD FOR THOUGHT
32. GRAPES GRAPES EVERYWHERE
33. GRAPES OF WORTH
34. GRIPES AND GRAPES
35. GROPE FOR GRAPES
36. GRUESOME GRAPES
37. HAVE GRAPES, WILL HANG
38. HOW DRY I AM
39. HOW HIGH THE BRANCH
40. HOW I LEARNED TO HATE GRAPES

41. I CAN'T GET HIGH ENOUGH ON GRAPES
42. I'D SOONER ORANGES
43. IF AT FIRST YOU DON'T SUCCEED SKIP IT
44. IF AT FIRST YOU DON'T SUCCEED GIVE UP

45. IF AT FIRST YOU DON'T SUCCEED TRY A NEW ANGLE
46. IT'S A GRAPE DAY
47. LA DOLCE VITA
48. LEAP AND LEARN
49. MANY A FOX GOES DRY
50. MISSED BUT NOT MISSED
51. NO GERITOL TODAY
52. ONE APATHETIC FOX
53. ONE GOOD LEAP DESERVES ANOTHER AND ANOTHER AND ANOTHER
54. OUTFOXED FOX
55. SHORT FOX HIGH BRANCH
56. SHORTY
57. SOUR SUMMER DAY
58. SWEET OR SOUR?
59. SWING LOW

60. TANGLED TANTALIZERS
61. THAT WAS THE LUNCH THAT WAS
62. THAT'S THE WAY THE BRANCH BENDS
63. THE ATTEMPTED RAPE OF THE GRAPE
64. THE EFFECT OF HEIGHT ON THE TASTE OF GRAPES
65. THE FOX IS FOILED AGAIN
66. THE FOX THAT FAILED
67. THE GRAPE TEMPTATION
68. THE GRAPES OF WRATH
69. THE GRAPES THAT GOT AWAY
70. THE GREAT GRAPE GRABBER
71. THE HEIGHTS TO WHICH A THIRST CAN DRIVE YOU
72. THE HIGH BRANCH THE LOW JUMP
73. THE MIDGET FOX
74. THE OLD FOX ISN'T WHAT HE USED TO BE
75. THE PURPLE THIRST
76. THE QUICK BROWN FOX....
77. THE RISE AND FALL OF THE FOX
78. THE SHORT FOX AND THE HIGH BRANCH
79. THE SOUR FOX
80. THE "SOUR" LOSER
81. THE SOUR PUSS FOX
82. THE SOURED FOX
83. THE TRIALS AND TRIBULATIONS OF A SHORT LEGGED FOX
84. THE UTTERANCES OF A WILD FOX
85. THE WHOLE GRAPE OR NOTHING BUT THE GRAPE
86. TOO MANY GRAPES SPOILED THE FOX
87. WHO GREASED THE GRAPEVINES?
88. WINING OVER GRAPES
89. WITHOUT A LADDER A BIT SADDER

90. YE OLDE SOUR GRAPES TALE -- A MORAL FOR MEN

APPENDIX C

Communalities of the Factor Solutions (Table 32)

Principal Factor Pattern for Divergent Thinking and Convergent Thinking Variables in the Total Sample (Table 33)

Principal Factor Pattern for Divergent Thinking and Convergent Thinking Variables in the Male Sample (Table 34)

Principal Factor Pattern for Divergent Thinking and Convergent Thinking Variables in the Female Sample (Table 35)

Intercorrelations of Main Variables (Table 36) Total

Intercorrelations Of Main Variables (Table 37) Male

Intercorrelations of Main Variables (Table 38) Female

TABLE 32

COMMUNALITIES OF THE FACTOR SOLUTIONS

	Communalities (h^2)		
Variables	Total Sample	Male Sample	Female Sample
Uses Fluency	.878	.789	.873
Uses Flexibility	.875	.783	.869
Consequences Flexibility	.802	.513	.791
Anagram Uncommon	.794	.787	.789
Anagram Fluency	.789	.733	.810
Consequences Fluency	.753	.528	.763
SAT-V	.694	.640	.746
Word Meanings	.563	.578	.536
SAT-M	.512	.518	.539
Plot Titles Fluency	.431	.468	.402
Plot Titles Quality	.129	.291	.074

Note. - Total Sample N = 417; Male Sample N = 117; Female Sample N = 300.

TABLE 33

PRINCIPAL FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE TOTAL SAMPLE

Variable	Factors					
	I	II	III	IV	V	VI
Uses Flexibility	761	-438	-055	-318	101	-245
Uses Fluency	754	-470	-062	-290	160	-216
Consequences Fluency	671	-093	171	515	007	061
Word Meanings	606	271	212	-277	039	416
Plot Titles Fluency	531	-294	-251	002	-126	341
Consequences Flexibility	509	-069	252	689	097	-035
Anagram Uncommon	410	618	-491	-027	102	-035
Anagram Fluency	356	619	-510	140	180	-078
SAT-V	343	488	517	-267	-032	260
Plot Titles Quality	325	072	-133	015	-911	-109
SAT-M	223	504	447	-090	-029	-529

Note. - Decimals are omitted.
SAT-V and SAT-M are the convergent thinking variables.
N = 417

TABLE 34

PRINCIPAL FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE MALE SAMPLE

Variable	Factors					
	I	II	III	IV	V	VI
Uses Flexibility	747	-469	-070	377	000	016
Uses Fluency	731	-499	-070	392	065	-012
Consequences Fluency	698	-156	131	-462	-157	-005
Word Meanings	680	305	149	073	220	346
Plot Titles Fluency	579	-268	-247	-177	290	-031
Consequences Flexibility	557	-222	391	-454	-077	-349
Anagram Uncommon	450	672	-363	008	099	-181
Anagram Fluency	445	637	-359	011	111	-314
Plot Titles Quality	413	171	-303	001	-782	237
SAT-V	374	503	498	-044	135	436
SAT-M	159	325	622	429	-216	-394

Note. - SAT-V and SAT-M are the convergent thinking variables.

N = 117

TABLE 35

PRINCIPAL FACTOR PATTERN FOR DIVERGENT THINKING AND CONVERGENT THINKING VARIABLES IN THE FEMALE SAMPLE

	Factors				
Variable	I	II	III	IV	V
Uses Flexibility	766	-433	-106	-290	114
Uses Fluency	764	-467	-075	-257	169
Consequences Fluency	655	064	177	545	063
Word Meanings	573	242	-375	-097	128
Plot Titles Fluency	505	-317	160	-145	-278
Consequences Flexibility	488	016	256	698	085
Anagram Uncommon	404	589	387	-360	014
SAT-V	341	451	-649	071	-022
Anagram Fluency	340	612	526	-209	080
Plot Titles Quality	271	013	-013	018	-915
SAT-M	262	599	-302	142	-035

Note. - SAT-V and SAT-M are the convergent thinking variables.
N = 300

TABLE 36

INTERCORRELATIONS OF MAIN VARIABLES

(Total Sample, N = 417)

	1	2	3	4	5	6	7	8	9	10	11
1											
2	62										
3	07	11									
4	09	15	16								
5	21	27	20	13							
6	13	20	-01	08	41						
7	17	17	-06	06	19	33					
8	12	18	15	16	23	24	03				
9	02	08	40	11	30	05	-01	16			
10	03	10	37	17	31	08	01	22	93		
11	17	10	31	17	29	14	10	22	37	35	
12	10	08	17	08	16	10	09	19	24	23	54

Note. - Decimals are omitted.
Required for significance at the .05 level, 4 = .10, at the .01 level, r = .13.
The numbered variables are named below.

1. Anagram Fluency
2. Anagram Uncommon
3. Plot Titles Fluency
4. Plot Titles Quality
5. Word Meanings
6. SAT-V
7. SAT-M
8. Essay Total
9. Uses Fluency
10. Uses Flexibility
11. Consequences Fluency
12. Consequences Flexibility

TABLE 37

INTERCORRELATIONS OF MAIN VARIABLES

(Male sample, N = 117)

	1	2	3	4	5	6	7	8	9	10	11
1											
2	69										
3	14	15									
4	22	27	14								
5	34	37	29	21							
6	21	28	01	09	47						
7	12	09	-10	04	17	28					
8	16	15	14	25	24	28	16				
9	06	05	45	17	33	01	03	19			
10	08	07	40	23	34	04	02	25	93		
11	18	13	35	27	35	22	00	17	41	42	
12	04	05	29	08	24	15	14	24	32	35	54

Note. - Decimals are omitted.

Required for significance at the .05 level, r = .18, at the .01 level, r = .24.

The numbered variables are named below.

1. Anagram Fluency
2. Anagram Uncommon
3. Plot Titles Fluency
4. Plot Titles Quality
5. Word Meanings
6. SAT-V
7. SAT-M
8. Essay Total
9. Uses Fluency
10. Uses Flexibility
11. Consequences Fluency
12. Consequences Flexibility

TABLE 38

INTERCORRELATIONS OF MAIN VARIABLES

(Female Sample, N = 300)

	1	2	3	4	5	6	7	8	9	10	11
1											
2	60										
3	04	09									
4	04	09	17								
5	17	23	16	07							
6	06	17	-02	10	39						
7	24	22	-04	07	20	37					
8	09	18	16	12	23	22	-01				
9	02	10	38	09	29	07	-04	15			
10	03	11	36	15	30	10	00	21	93		
11	17	09	28	12	26	10	15	25	36	33	
12	12	10	12	09	13	08	07	17	22	19	55

Note. - Decimals are omitted.

Required for significance at the .05 level, r =.11; at the .01 level, r = .15.

The numbered variables are named below.

1. Anagram Fluency
2. Anagram Uncommon
3. Plot Titles Fluency
4. Plot Titles Quality
5. Word Meanings
6. SAT-V
7. SAT-M
8. Essay Total
9. Uses Fluency
10. Uses Flexibility
11. Consequences Fluency
12. Consequences Flexibility